The FOUNDRY

Volume 55
Number 24

Published
Semimonthly

CLEVELAND, OHIO, DECEMBER 15, 1927

Clamer Is Made Chairman of Convention Committee

PLANS rapidly are being completed for the 1928 convention and exhibition of the American Foundrymen's association, to be held in Philadelphia, May 14-18. Guilliam H. Clamer, president of the Ajax Metal Co., Philadelphia, recently has been appointed general chairman of the Philadelphia committee by the executive committee of the Philadelphia Foundrymen's association. Mr. Clamer, who has been prominently identified with the activities of the American Foundrymen's association, the Philadelphia Foundrymen's association and other groups for a number of years, will have charge of the various committees, composed of leaders of the industry in the Philadelphia district. These committees will arrange the various entertainment features for the foundrymen attending the annual gathering. Mr. Clamer was born in Philadelphia and was graduated from the public schools of that city. He worked for two years in the private chemical laboratory of D. F. A. Genth and then entered the University of Pennsylvania where he completed his course in chemistry in 1897. He became affiliated with the Ajax Metal Co. and during the intervening years has advanced from a position of chemist to president of the company. Mr. Clamer is recognized as one of foremost metallurgists in the nonferrous industry and has received several awards for his work in metallurgical research. In 1924 he served as president of the American Foundrymen's association and was a member of the board of directors of that organization from 1920 to 1927. He also is a past president of the American Society for Testing Materials.

CONTENTS

SPECIAL FEATURES

Page

Giant Steel Castings Dominate Power Project ... 950
Newark Holds Joint Meeting ... 955
Bring the Benefits Home—By Walter L. Seelbach ... 957
Summarizes Data on Growth Tests—By Dr. J. H. Andrew ... 959
Power Conveyors Handle Large Molds ... 962
Chill Molds Effective in Casting Lead Textile Machine Parts—By E. R. McCuiston ... 967
Bill Calculates Bricks in Melting Zone—By Pat Dwyer ... 968
Investigates Characteristics of Steel Foundry Sands—By E. R. Young ... 971
New Device Dries Molds Electrically—By Robert Corey Deale 974
Outerbridge Awarded Gold Medal ... 976
Liquation Causes Scabs—By David Rogers ... 977

REGULAR DEPARTMENTS

How and Why in Brass Founding — By Charles Vickers ... 966
What Others Are Thinking 978
Family Photograph Album 979
The Shakeout ... 980
Trade Trends in Tabloid ... 981
Comings and Goings of Foundrymen ... 982
Foundry Association Directory ... 983
What the Foundries Are Doing ... 986

—⊡—

PUBLISHED BY THE PENTON PUBLISHING CO., CLEVELAND, O.
BRANCH OFFICES

CHICAGO ... 1147 Peoples Gas Bldg.
CINCINNATI ... 209 Edwards Bldg.
NEW YORK ... 2203-2206 No. 220 Broadway
PITTSBURGH ... 2148-49 Oliver Bldg.
SAN FRANCISCO ... 24 California Street
WASHINGTON, D. C. ... 1653 Pennsylvania Avenue
BIRMINGHAM, ENGLAND ... Prince's Chambers
LONDON, ENGLAND ... 416-417 Caxton House, Westminster, S. W. 1
PARIS, FRANCE ... No. 9 Rue de Londres
BERLIN, GERMANY ... Wilhelmstrasse 114, Berlin SW. 48

Cable address, IROTRAPEN, London

SUBSCRIPTION

United States and Mexico ... $3.00 a year
Canada ... $4.00 a year
Great Britain and other Foreign Countries ... £1:0:0 a year
Single copies ... 25 cents

Copies published three months or more previous to date of current issue, 50 cents each

Member, Audit Bureau of Circulations, Associated Business Papers Inc., National Publishers Association

The A. B. P. is a nonprofit organization whose members have pledged themselves to a working code of practice in which the interests of the men of American industry, trade and professions are placed first—a code demanding unbiased editorial pages, classified and verified paid subscribers, and honest advertising of dependable products

Copyright 1927 by the Penton Publishing Co.

Giant Steel Castings

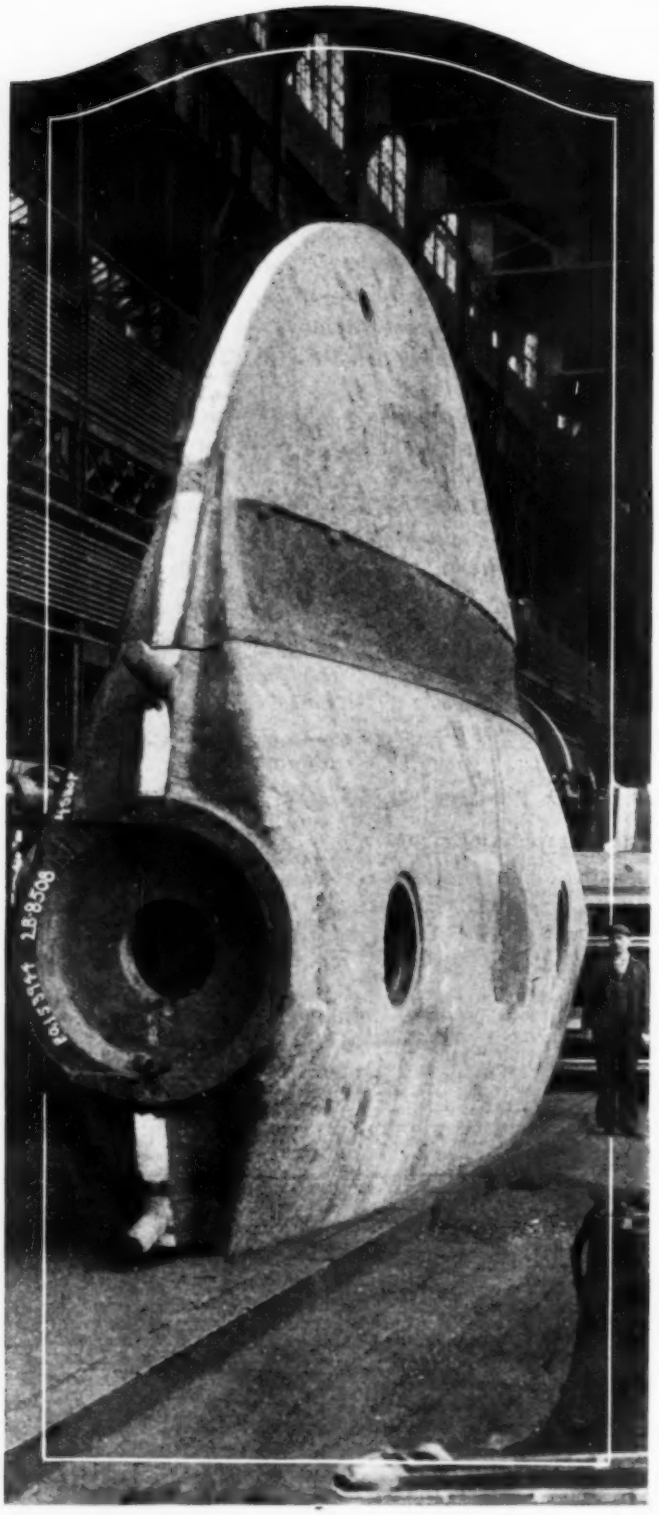


Fig. 1—Two Sections Assembled as Part of the 27-foot Diameter, Cast Steel, Butterfly Valve for Conowingo Development of the Susquehanna Power Co. Approximate Weight of Two Parts 116 Tons

SCIENTISTS assure us that some day the sun's rays will be harnessed to do all our work. An inexhaustible source of energy then will be available to turn the myriad wheels of industry, commerce and pleasure. The phenomenon will excite no more comment or arouse no more interest or curiosity than the radio or wireless telegraph does at present.

In the meantime, until that happy day arrives when the millwright or engineer can tune in any time for all the power he requires either for a short period or for a continuous indefinite period, the wheels of industry will continue to receive their impetus from steam or electric current. Steam is costly whether utilized directly or converted into electric current for transmission long or short distances. Coal constitutes a heavy operating charge and the same applies of course to gas and oil whether burned under the boilers or in one of the various types of internal combustion engines.

Under these conditions it is not surprising to find that the engineering fraternity year by year is devoting more attention to harnessing a great natural force, available in many sections of the country and with the characteristics of which the members are fairly familiar.

Whether flowing smoothly down a gentle incline, rushing at breakneck speed through a rapid or roaring over a cliff in a smother of foam and spray, the rivers of the country carry potential horsepower sufficient to operate a heavy proportion of all mechanical equipment within the borders. For hundreds, perhaps thousands of years, these millions of turbulent white horses have come plunging down from the hills, through the valleys and have been lost in the sea. Until recent years, little attempt was made to adjust a bridle and a pair of traces in an effort to utilize some of the stupendous energy apparently going to waste.

As a prime mover, the water wheel was known to the ancients. Plain wood paddle wheels under and overshot were used for many purposes in the eighteenth and the greater part of the nineteenth century. Development of the electric motor generator and the turbine type of water wheel late in the nineteenth century opened a new field for the conversion of waterpower on a large scale into easily transportable electric form of energy.

Dominate

Power Project

ALL design and construction operations of the Conowingo dam and powerhouse are under the supervision of W. C. L. Englin, vice president and chief engineer, Philadelphia Electric Co., Philadelphia. The operation of the dam and powerhouse will come under the charge of the engineering department of the same company when they are ready for service. Contract for the design and construction of the dam was awarded Stone & Webster, Inc., Boston, which has divided the construction work with the Arundel Corp., Baltimore.

To facilitate delivery, the contract for the seven power units was divided between the Allis-Chalmers Co., Milwaukee, and the I. P. Morris Co., Philadelphia. The first company supplied four, while the second company made three. General Electric Co. made four generators and the Westinghouse Electric & Mfg. Co. furnished the other three. The Westinghouse Co. also supplied the two station service generators to be driven by wheels made by S. Morgan Smith Co., York, Pa. Steel castings, wheels, wickets and butterfly valves, the largest ever constructed for water power control, were made by the Falk Corp., Milwaukee; Otis Steel Co., Cleveland, and Wheeling Mold & Foundry Co., Wheeling, W. Va.

Since that time many notable hydro-electric plants have been installed and as might be expected, the size of the units constantly has increased. Iron, bronze and steel have taken the place of the old wood millwheel. The engineering world was thrilled in 1890 when the first battery of ten bronze wheels was set up at Niagara Falls, each wheel capable of delivering 5000 horsepower.

At the Conowingo dam now under construction close to the Pennsylvania-Maryland border, about four miles above tidewater on the Susquehanna river, an initial installation of seven units will generate 378,000 horsepower, or 54,000 horsepower for each unit. Eventually the installation will include 11 units capable of delivering approximately 600,000 horsepower.

The magnitude of this undertaking designed to furnish electric current to the city of Philadelphia, 70 miles away may be visualized to some extent by a brief presentation of some of the principal features. The first and perhaps most pertinent is that the entire cost of the project including the transmission lines is estimated at $52,200,000.

The dam itself is 4800 feet in length, that is

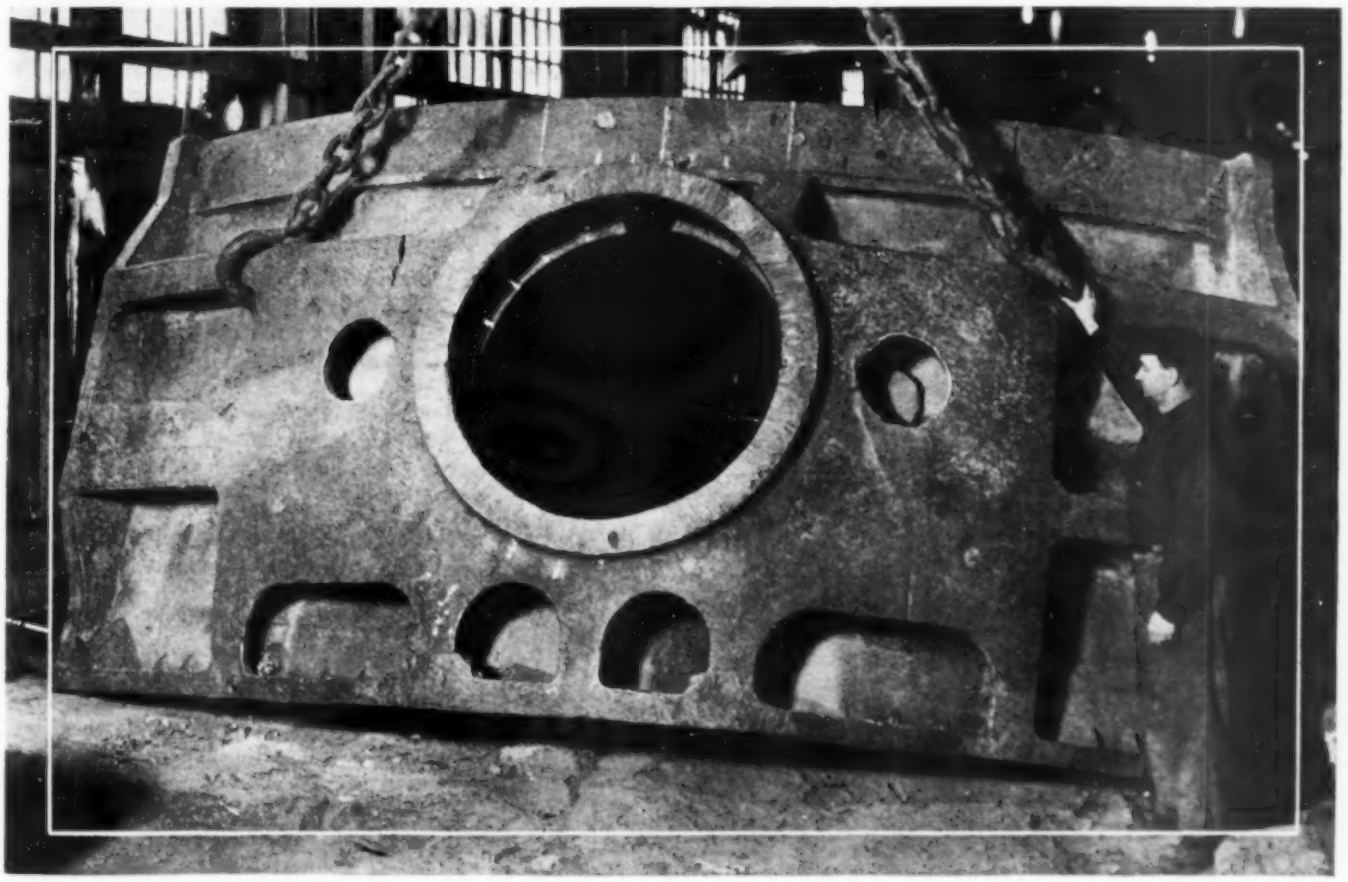


Fig. 2—One of the Spindle Bearing Sections of the Valve Housing as it Appeared on the Floor of the Cleaning Room

Fig. 3—Metal Enters the Mold Through Tiles Near the Bottom

almost a mile from one side of the river valley to the other, and exceeds the length of the famous Muscle Shoals dam by 300 feet. It will provide an 89-foot head of water for the turbines designed to run at a speed of 81.8 revolutions per minute. The pool formed by backing up the waters of the river has an area of approximately 14 square miles and will extend back from the dam to the tail race of the Holtwood station.

This station was built by the Pennsylvania Water & Power Co., about 15 years ago to furnish electric current to the city of Baltimore, 45 miles away. The equipment can develop a total of 150,000 horsepower.

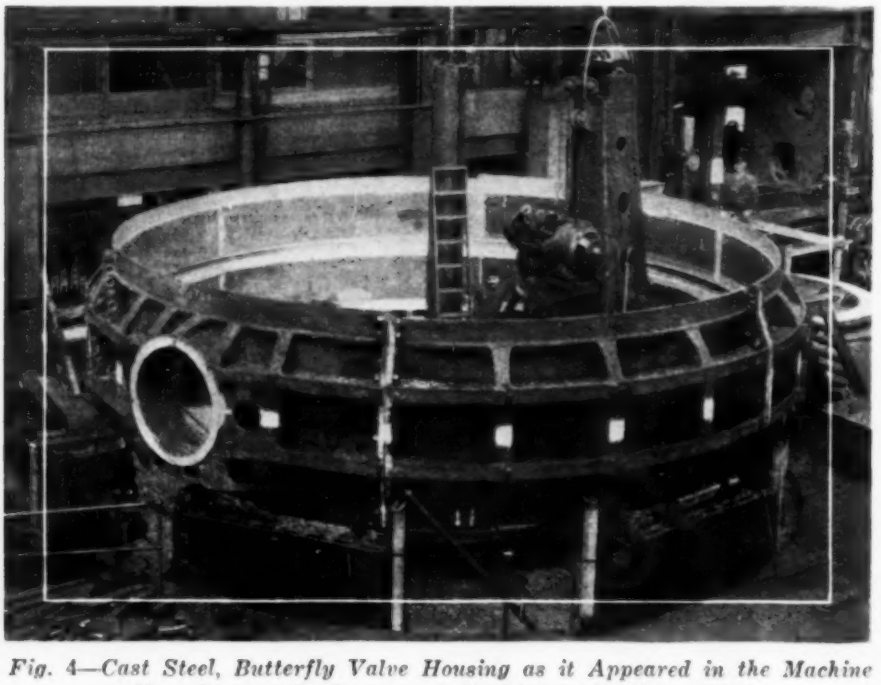


Fig. 4—Cast Steel, Butterfly Valve Housing as it Appeared in the Machine Shop During the Process of Machining the Valve Seat

Fig. 5—One of the Wicket Center Sections for a 27-foot Diameter, Butterfly Valve. Weight of this Casting Is Given as 126,245 Pounds

During the centuries that have elapsed since the majestic Susquehanna first started to cut its way to the sea, the stream has worn a deep path for itself even through the granite rock. Especially in the lower section of the river this erosive action has resulted in a valley with steep sides particularly adaptable to the erection of dams for waterpower development.

Conservative estimate places the area drained by the Susquehanna at 27,400 square miles. It includes 47 per cent of the area of Pennsylvania, 13 per cent of the state of New York and 2 per cent of the state of Maryland.

Average annual precipitation over this area is 39.4 inches and the run-off that reaches the sea through the Susquehanna and its numerous tributaries generally amounts to 55 per cent of the rainfall during any 12-month period. On account of the wide variation in the volume of water at certain periods of the year, the engineers have had an additional angle added to the already fairly complicated construction problem. This angle was particularly prominent while clearing the site and while rearing the final part of the dam. Lowest recorded discharge of the river was at the rate of 2200 cubic feet of water per second. Maximum movement during flood stages has hurled a torrent of boiling dark brown water, past the village of Conowingo at the rate of 730,000 cubic feet per second.

Seven Units Built

Average head available at the dam will be 89 feet and the flow of the river up to about 42,000 cubic feet per second will be utilized at this head through seven vertical shaft, single runner, Francis reaction-type, water wheels. Each water wheel will have a full gate capacity of not less than 54,000 horsepower and a capacity of 50,000 horsepower at the point of best efficiency. It will be direct connected to a 40,000 kilovolt-ampere, 13,000 volt, 81.8 revolution

per minute, three-phase, 60-cycle generator. Besides the seven main units and four others of similar capacity to be installed later, two station service generators will be provided. Each of these generators will be direct connected to a 1900-horsepower water wheel and will have a capacity of 1600 kilovolt-amperes, 480 volts running at 360 revolutions per minute.

Output of the main generators will be raised to 220,000 volts through suitable step-up transformers and will be transmitted 70 miles to Philadelphia through a two circuit transmission line connecting to the high tension switching structure on the roof of the station. The initial installation will include four 80,000-kilovolt transformer banks each consisting of three single-phase units.

Although it is claimed this water power project will effect a saving of approximately 750,000 tons of coal annually, it is claimed it is economically feasible only because it is hooked up with a large steam power system already operated by the Philadelphia Electric Co.

Fig. 7—Mold for Large Steel Forging Machine Frame Made in the Floor

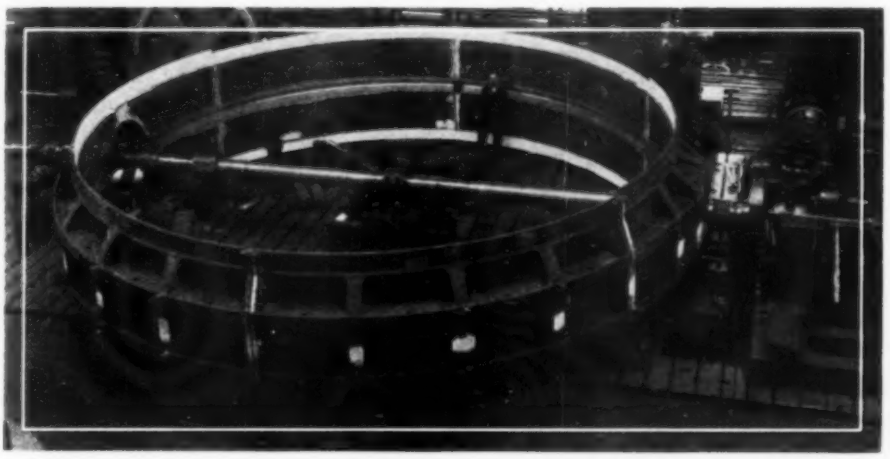


Fig. 6—A Single Boring Bar Employed in Machining the Valve Spindle Bearings Was Supported in the Center and at Both Ends

Making Progress

Construction was started on the project on March 8, 1926 and it is expected that the first unit will be placed in operation before July 1928 and that the entire capacity of the power station will be available to assist the Philadelphia Electric Co., in carrying its peak loads in December, 1928.

First concrete was poured on August 2, 1926 and up to June 1, 1927, about 44,000 cubic yards of concrete out of a total of 660,000 yards required, had been poured.

From the foregoing brief presentation it is apparent that everything in connection with this undertaking is on an extremely large scale. This description also applies to the steel castings that go to make up the various operating units. Some of these castings it is claimed are the largest ever manufactured for a like purpose.

Only a comparatively small number of steel foundries are equipped to handle large steel castings of the size, shape or weight of the butterfly valve shown in the accompanying illustration Fig. 1. Four sets of these valves and complete wicket rings, out of the seven sets required for the Conowingo dam development, were made in the steel foundry of the Otis Steel Co., Cleveland. Illustrations of other molds are presented to indicate in a general way the character of the castings handled in this foundry which for many years has specialized in the manufacture of steel rolls and castings for heavy machinery.

The shop is equipped with three, 25-ton, acid-lined, open-hearth furnaces, but even this ample melting capacity was taxed almost to the limit to pour each of the four center sections for the butterfly valves. One of these sections is shown in Fig. 5 on the planer where a recessed joint was machined on each side. In Fig. 1 one of the center sections is shown on the floor of the erection shop with

Fig. 8—Green Sand Mold, the Interior Filled with Dry Sand Cores Is Employed for Making Casting for a Locomotive Crane Base

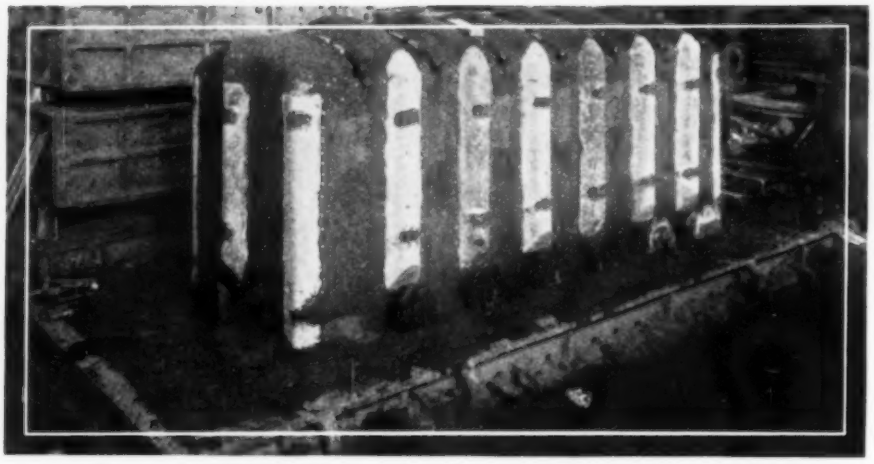


Fig. 9—Simplified Pattern Equipment Is Employed in Making Annealing Boxes

one of the side sections fitted in place. Space on the inside of the casting is ample for the operator to tighten the bolts which hold the sections together.

The center section of the valve is 27 feet in length, approximately 10 feet wide and about 5 feet through near the center. The interior is hollow, reinforced by longitudinal and transverse ribs. The cleaned casting weighs 63 tons, which means that approximately 75 tons of steel were needed in the three ladles from which it was cast. Each of the side sections is somewhat smaller in length and width and weighs 53 tons.

One-Piece Pattern

The mold for this casting was made in one of the large concrete pits maintained in the floor of the foundry for the purpose. A simple, one-piece, box pattern was employed to form the outside of the mold. The slots along the sides and all the ribs on the interior were formed by adjusting a set of dry sand cores. These cores formed the openings which may be noted in the side of the casting in Fig. 5. They rested in prints along both sides and both ends and rested on suitable chaplets along the center. Core prints on the top, also a number of chaplets, anchored the cores in place and prevented them from moving while the mold was filling with the metal.

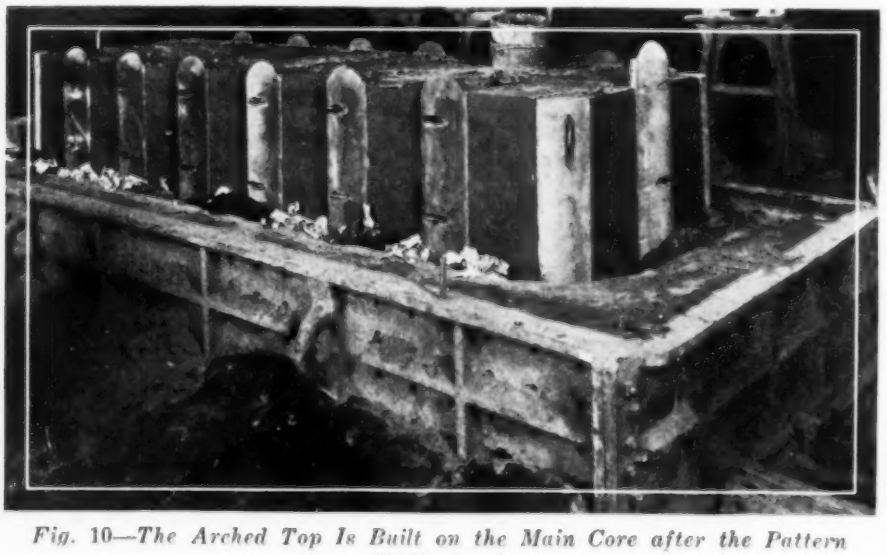


Fig. 10—The Arched Top Is Built on the Main Core after the Pattern Is Removed

After the pattern was removed, the mold was dried for several days by a number of jets connected with the gas main. The cores then were placed in their proper position according to a numbered blueprint and the cope was lowered into place. Sink heads were built up to feed approximately every 10 square feet of surface measurement and were disposed in three longitudinal lines. Heavy steel blooms from the adjoining rolling mill of the Otis Steel Co., were placed across the top of the cope and anchored down at the ends by heavy bolts let into the concrete walls of the pit. Three ladles were employed to pour the casting through a gate at each end and one in the center of one side.

Normal contraction on a steel casting 27 feet in length is 6¾ inches. Fortunately the sloping shape of this casting offered no impediment to contraction on the outside. A space was

Fig. 11—Annealing Box in Cleaning Room

cleared around each sinkhead before contraction commenced. The cores were faced with a highly refractory sand, but the inside was filled with coke and old sand without a binder. Consequently these cores crushed easily when the casting commenced to contract.

Analysis of these castings showed an average of: Carbon 0.30 per cent, sulphur 0.04 per cent, phosphorus 0.03 per cent, silicon 0.25 per cent, manganese 0.50 per cent. The castings were allowed to remain in the mold for a week after they were poured and they received no further annealing.

Large Valve Housing

One of the sections for the valve housing as it appeared in the cleaning room of the Otis Steel Co., is shown in Fig. 2. The complete housing ring made up of six sections is shown in two positions in the machine shop of the Allis-Chalmers Co.,

Milwaukee. In each position it will be noted that the assembled ring remains stationary during the machining operation. In Fig. 6 a boring bar supported in suitable bearings at each end and in the center is shown machining the opening for the valve spindle. In Fig. 4 the assembled ring is shown set up around a boring mill in which the tool post travels with the table to form the valve seat inside the stationary housing.

The mold for a large forging press frame to weigh approximately 40 tons indicates the method by which this work was handled and is shown in views taken from both ends in Figs. 3 and 7. Pattern construction on this and all large jobs is held to a minimum, by the expedient of forming practically all parts of the casting in a set of dry sand cores. This method reduces patternmaking and molding expense and takes a great deal of the hazard out of the production of the casting. In the two illustrations it will be noted that with the exception of a few limited surfaces which the molds are reinforced with nails, the entire mold simply is a glorified coreprint. All the surfaces exposed to the metal are reinforced with facing sand, but the straight walls at the sides, one end and the greater part of the flat area on the bottom are formed from heap sand.

Vent from many of the cores is taken through a coke bed under the mold from which it passes up to the open air through suitable pieces of vertical pipe. Vent from the remainder of the cores either is taken through the cope or through the vertical channels which examination of the illustrations will disclose cut in the walls of the mold. Three-inch tile runners conduct the metal simultaneously from two ladles into the bottom of the mold at both ends. Two gates are shown quite clearly in the lower part of one end of the mold in Fig. 3. After the mold has been finished and surface nailed it is painted with silica wash—a cream-like mixture of silica flour and molasses water—then the open top of the mold is covered temporarily with light steel sheets, while a number of gas jets dry the sand to a depth of 3 or 4 inches.

Make Annealing Boxes

Otis Steel Co., for many years has been engaged in the manufacture of special types of steel castings. One class of these is annealing boxes of the type used in sheet mills. A typical example of one of these castings is shown in Fig. 11. Molds for two of these castings in process of construction are shown in Figs. 9 and 10. The mold is made in a three part flask and is poured through a bottom runner at one end. In the drag the runner is divided into two branches which conduct the metal simultaneously up into the two sides of the mold, as shown in Fig. 9.

Patternmaking on this job also has been simplified. A plain rectangular frame is placed on the face of a drag which has been rammed full of sand and scraped off flush with the joint. The pattern is braced on the inside and the space between the outside and the walls of the cheek flask is rammed full of sand. Sand also is rammed on the inside to a height of about 12 inches to serve later as a guide in replacing the pattern. A wood cover is placed on the pattern and the cope is rammed and lifted off. Then the box pattern is drawn and the cheek part of the mold is removed. The box pattern then is replaced on the drag and the inside is rammed full of sand up to the point where the arch commences. The box then is removed, cores to form the flutes in the sides are attached by wires to anchors in the center and a light frame is adjusted to guide the strikes in forming the ribs and arches on the top.

Interesting example of a part dry and part green sand mold for a locomotive crane base is shown in the illustration Fig. 8. The interior part of the mold is formed with a set of oil sand cores designed to crush easily. The remainder of the mold is made of green sand.

Newark Holds Joint Meeting

GROUP methods of quoting on castings were vigorously attacked by E. H. Ballard, general foundry and pattern superintendent, General Electric Co., Lynn, Mass., before a large gathering of foundrymen in Newark, N. J., Nov. 30. The occasion was a joint meeting of the Newark Foundrymen's association and the metropolitan section of the American Society of Mechanical Engineers.

The speaker asserted that the method of classifying castings and establishing schedules by weight is wrong as the true cost of any individual casting is lost. He believes that the grouping of a number of classes is worthwhile as a check on the average cost of a group, but for billing and accounting knowledge of true conditions, each individual casting should be figured and billed at its own cost. This, Mr. Ballard asserted, has the further advantage of attracting the attention of the designing engineer to the casting, as it often results in further simplification of the casting and in turn a reduction in the expense.

Discussing the need for closer cooperation between the designing engineer, pattern shop, foundry and machine shop, Mr. Ballard asserted that drawings for castings should not be considered completed until the foundryman has approved these castings and in most cases been consulted. He recommended that full sized castings should be made for intelligent study. Few foundrymen, the speaker declared, can make scaled drawings and properly visualize the sections and areas.

At the Everett, Mass., plant of the General Electric Co., where castings of very large dimensions are produced, molding and machining never is undertaken until there has been a study of the full size layout to determine the method of heading and gating. At this plant they have accumulated a record of methods of heading and gating by photographing castings in the rough. These photographs are marked with dimensions, sizes of heads and the gross and net weight necessary to cast. As a result, the company is able to repeat good practices.

The speaker also declared that the foundry should be advised as to any unusual conditions under which the castings are to be machined or subjected to tests or used in service. At the General Electric plant a system of marking patterns to show the finished surfaces enables the foundryman quickly to determine the method of molding that will insure the best results. Practically all cope surfaces on miscellaneous work are distinguished by a symbol cast in raised figures. In the chillings of castings such places as are to be chilled are indicated on the pattern by the word chill. The shape of the chill to be used also is outlined.

A marked reduction in the cost of castings can be brought about by engineers working into designs all

webs, brackets and liberal fillets as a permanent part of the castings. He said it is not uncommon to see a molder increasing the size of fillets by cutting out sand after the pattern has been withdrawn from the mold. He believes there should be an agreement on standard fillets and radii for various sections. He also holds that where the foundry is of good size an engineer, armed with a certain amount of authority to work between the various departments with a view to bringing about closer cooperation, would be well worth while.

He discussed the question of the submitting and approval of sample castings to be made in quantity lots and machined by use of jigs and fixtures. It is natural, he said, to expect a slight variance in cored castings and unless machine shops build their jigs and fixtures with due regard to reasonable variations, delay will result. He stated that his plant has inaugurated a plan whereby the machine shop and foundry get together on new designs before jigs are built and a sufficient number of castings are made to determine variations which exist and can be tolerated. Mr. Ballard stressed the importance of maintaining modern equipment.

Another interesting speaker was R. T. Turner, sales promotion manager, Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., who delivered an illustrated address on mechanical handling in foundries. He cited many cases, illustrating where mechanical conveying equipment has effected great savings in both time and money and eliminated much arduous labor.

Mr. Turner confined his remarks to a description of various features of electric overhead equipment. He summed up his keynote in the following phrase: Fewer moves, shorter distances, and fewer number of men. He pointed to a bucket system of charging cupolas as having many distinct advantages. Among various installations, he showed one whereby materials for cupolas in a foundry, producing 125 tons a day, were handled by a single electric transfer hoist.

John L. Carter, president of the Newark Foundrymen's association, in a general discussion that followed the principal addresses urged that foundry jobbers insist on proper designs. Considerable money is lost by foundrymen each year in endeavoring to make castings from the improper designs that have been provided. S. H. Libby, consulting hoist engineer of the General Electric Co., Bloomfield, N. J., and formerly a foundryman, served as chairman of the meeting.

Will Prepare Papers for European Meets

John Howe Hall, metallurgist, Taylor Wharton Iron & Steel Co., High Bridge, N. J., and H. A. Schwartz, director of research, National Malleable & Steel Castings Co., Cleveland have been chosen by the American Foundrymen's association to present two of the American exchange Papers at 1928 meetings of the European foundry associations.

Mr. Hall will present the exchange paper at the next annual meeting of the Institute of British Foundrymen and Mr. Schwartz at the meeting of the Association Technique de Fonderie de France, the French foundry association corresponding in its activities to the American Foundrymen's association.

John W. Bolton, metallurgist for the Lunkenheimer Co. Cincinnati has been chosen to present the 1929 American Foundrymen's association exchange paper before the Institute of British Foundrymen. This will be the third international foundry congress, the first being held in Paris in 1923 and the second in Detroit in 1926.

The presentation of exchange papers by the leading foundry associations of the world was started in 1921, largely through the efforts of the late A. O. Backert a past president of the American Foundrymen's association, and H. C. Estep, chairman of the American Foundrymen's association committee on international relations. This exchange has gone far toward drawing the foundrymen of the world closer together and giving them an understanding of the problems facing the industry in the various countries.

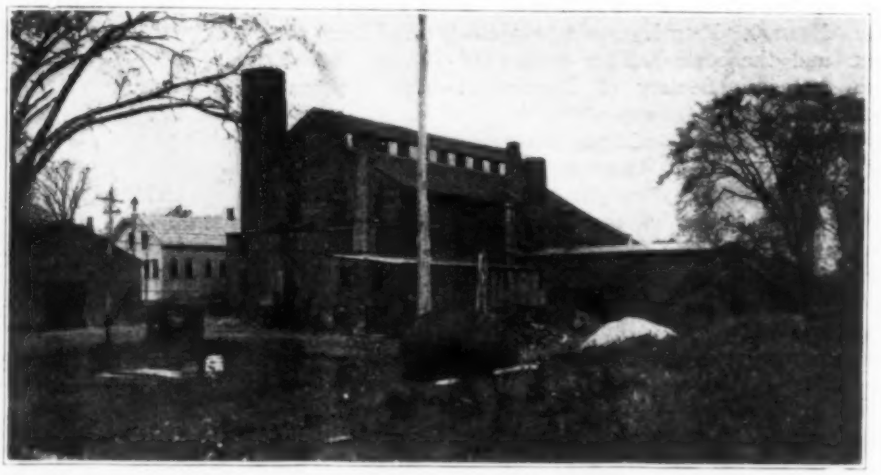
A further accomplishment of this co-operation of the foundry associations has been the formation of an international committee to regulate the holding of international foundry congresses. This committee formed early this year has formulated a schedule of international meetings one to be held every three years, successively in England, Germany, France and America.

Historic Foundry To Be Torn Down

The old foundry of the Stanley Works at Bridgewater, Mass., finally is to succumb to the advance of modern industry. The foundry, which is the small building shown at the left of the accompanying illustration, is generally understood to be 200 years old or more. The first iron used in this foundry was obtained from bog ore dredged from the bottom of the mill pond and smelted in a primitive type of furnace, using charcoal for fuel. The remainder of the plant shown in the illustration has recently been abandoned by the Stanley works. These buildings were all built 100 years ago or more, and the whole district of Bridgewater is surrounded by the lore and tradition of the early iron industry in this country.

The town of Bridgewater was incorporated in 1649 and it was not long after this that the early colonists started the manufacture of iron near where the present plant is located. Guns and shot for several wars were made in the old plant. During recent years it was used for the production of bands and hot-rolled strip steel by the Stanley Works, New Britain, Conn. The capacity of the plant in 1922 was about 35,000 tons annually.

Cast-iron, steam-heating boilers valued at $14,109,348 were produced in 1925 according to the bureau of census report.



THE ENTIRE PLANT WILL BE WRECKED. THE SMALL BUILDING AT THE EXTREME LEFT WAS BUILT AND USED AS A FOUNDRY 200 YEARS AGO

Bring the Benefits HOME

How the Services of a National Association Could Be Brought to Bear on Purely Local Problems Through District Groups

By Walter L. Seelbach

OPPORTUNITIES for service by a national organization of gray iron foundrymen are many and varied. These have been outlined in addresses at meetings of castings manufacturers in various sections of the country, in conferences of foundrymen interested in the future welfare of the industry and through articles on the subject which have appeared from time to time in business papers. These wide expressions of opinion have been focused largely upon the broader problems of a trade association of the gray iron manufacturing interests.

Some have stressed the research idea. They have pointed to the work of existing technical and advisory groups in other industries. Uncertainty or variation in quality of gray iron castings has been given as one of the main handicaps which has been seized by manufacturers of competing products. To bring about uniformity, to give definite assurances of physicial qualities and to advance yet further the various properties which go to make a desirable product have been suggested phases of research on gray iron. Some have gone even further and advised a standard of specifications enforceable upon members of such a gray iron research group. This plan has been found of distinct advantage in another branch of castings manufacture and in other industries.

Find the Facts

Compilation of statistics on capacity and production upon a national scale is another phase of the work suggested for a national group of gray iron foundrymen. Obviously the possession of information of this nature, amplified by data that will picture the progress of the industry as a whole would be of distinct advantage. It would serve to prove or to refute loose statements that have worked harm upon the gray iron branch of the foundry industry for the past twenty years. An attempt to lay the groundwork of such statistics now is under way directed by the domestic commerce division of the department of commerce. If a wholehearted response to this government questionnaire is received, the data will be exceptionally valuable and probably will point the way to needed changes in business and commercial practices.

WALTER L. SEELBACH, the author of this article is well qualified to speak on the benefits of organization activities and is exceptionally well informed on the practical phases of castings manufacture and sales. He is secretary-treasurer of the Forest City-Walworth Run Foundries, Cleveland, having been associated with the Walworth Run Division of that organization since 1910 *when he was graduated from the Case School of Applied Science with a degree in civil engineering. Mr. Seelbach served two terms as president of the Ohio State Foundrymen's association and was active in promoting the work and service of that group of foundrymen from its inception.*

Merchandising methods obviously have not kept step with production technique in the gray iron castings industry. Within the past twenty-five or thirty years tremendous strides have been made in practically every department of gray iron foundries. Metallurgy has been improved. Melting methods have been changed in the interest of economy and improved product. Molding has progressed to the point where human fallibility has been displaced by mechanical accuracy. Many of the variables encountered in all lines of manufacture, but multiplied in the foundry industry, have been reduced to constants of known value. Witness present day knowledge on sand, its preparation, qualities, moisture and other factors and compare this enlightenment with the feel and guess practices of the past. Handling problems have been encountered and solved to the salvation of the human back and the reduction of a most important cost factor. In fact the entire procedure of castings manufacture has been altered, and multiple production of standard cast products has made possible many of yesterday's luxuries as today's necessities.

But They Can't Sell

However, castings merchandising methods in many cases partake of the dark ages and in this particular the gray iron branch particularly is unfortunate. Even in the most highly specialized elements of this industry is this true. Gray-iron castings produced upon a tonnage basis by the highly developed multiple production methods are sold almost entirely upon the buyers' price and under the purchas-

ers' code of practices as applies to pattern equipment, payment terms, deliveries, rejections and adjustments for defectives.

Obviously a great national association could do a great educational work among its members on merchandising subjects. Further, it could investigate new markets, develop new uses and finally it could defend gray-iron castings against the misrepresentation which in many instances has built up a buying resistance against gray iron castings. Truthful publicity of a broad nature is required to meet this latter situation.

All of these points have been considered previously. Perhaps a few new angles to these national efforts have been contributed by the writer directly or indirectly. Might not the work of the national group be furthered and in fact rendered much more valuable to the individual and to the entire industry through the later formation of local groups?

Local groups in this instance is not intended to mean those located within one city or small community. The sections or districts could be devised to include such territory as would yield the most benefit. For example, limitations of freight rates confine the purchase of gray iron castings, in many cases, to a definite territory, usually with a fairly definite radius of which a large consuming point is the center. Again, prevailing wage rates, the similarity of products or methods of manufacture set up geographical boundaries that could govern.

These smaller bodies could give more detailed consideration to problems of cost. They could exchange data on methods of arriving at a true understanding of their cost elements. Obviously costs vary widely throughout the nation but within each district uniformity will be approached, with benefit to all concerned. Estimates and prices based upon uniform costs cannot be so widely out of line as to injure either the foundries or their customers. The price cutter in a community where approved and uniform cost methods are in force encounters a united front which in event of ignorance of his own cost factors should bring about reform. Of course if such price cutting is the result of malice aforethought, instead of ignorance of cost, the situation will have to be left to take care of itself—and usually it does through the doors of the bankruptcy court which open wide for such manufacturers in due time.

In matters of shop methods, the comparison of operating efficiencies, the compilation of data on average costs within a district would be valuable. Such work has been carried on successfully in a number of localities with marked benefit. Such compilations would have to be made through an impartial agency and the fact that the average would be compiled from the same general class of foundries within a known community would give a basis for checking up on management and operating factors in basic costs.

Local groups could deal with matters connected with raw material markets. They could have access to data on purchases, deliveries and stocks on hand. In event of the return of forward buying of iron, such data would be even more valuable than it is today, under the prevalence of hand-to-mouth buying.

The national association could give valuable aid in establishing standards of service to customers, as has been mentioned. Local groups could police the individual members and secure adherence to these principles. The force of public opinion as exemplified in the smaller section with its more intimate association would be much more active.

In the relations of the individual members, one to another, the sectional or local body would be even more effective. Periodic informal meetings to discuss the general and local problems would yield results, particularly as concerns the educational elements of the national association, the application of uniform cost methods and the more local elements of merchandising problems.

However, the main benefit would be indirect but none the less effective. Acquaintanceship is one of the greatest forces in combating vicious competition. Unscrupulous buyers in many cases depend for their success upon promoting misunderstanding and distrust. If they can play one castings maker against the other, the resulting prices in many cases yield no profit to anyone. Even the buyer suffers in the long run from this promotion of distrust. Where a local group of foundrymen becomes acquainted each with the other through an active organization, competitors learn to know each other as men. They come to a common basis of respect which remains unshaken before the onslaughts of misrepresentation. They learn the policy of live and let live and absorb the principle which has been defined as the higher selfishness. That is, they learn to expect personal advancement through the general development of the industry.

Local Groups Could Handle Such a Situation as This

AT A SPECIAL meeting of all Hamilton foundrymen, which will be held at the chamber of commerce Monday night at 7:30 o'clock, the proposed reduction of pig-iron rates to Hamilton will be discussed.

During the course of a good year, over 60,000 tons of pig iron are received in Hamilton. Local foundrymen believe that if these reduced rates are successful it will mean a saving of approximately $9000 a year for Hamilton foundrymen. The Central railroad has agreed to a reduction of 15 cents a ton on pig iron in Hamilton.

Likewise if this proposed rate is successful it will mean more business to the Hamilton foundrymen. It will likewise mean that the Hamilton foundries will be able to get their supplies at a cheaper rate, and thus enable them to enlarge their production.

The meeting to be held Monday night, will be called by H. T. Ratliff, chairman of the Hamilton traffic council, who will be assisted by Karl J. Hepting, traffic manager of the Hamilton Foundry and Machine Co. Mr. Hepting and D. L. Mitchell, have been acting as a special committee.

The following foundries will have representatives at this meeting:

Hamilton Foundry and Machine Co., Estate Stove Co., Niles Tool Works, Hooven, Owens & Rentschler Co., Central Foundry Co., Iron City Foundry Co., Black-Clawson Co., Buckeye Foundry Co., Advance Foundry Co. and the H. P. Duescher Co.—HAMILTON, O., *Journal*, Nov. 12, 1927.

Summarizes Data on Growth Tests

Investigators of Growth in Cast Iron Have Conflicting Opinions—Presents Conclusions on Underlying Causes of Growth

By Dr. J. H. Andrew

A GLANCE at the bibliography relating to published researches on the growth of cast iron might give the impression that this problem had been thrashed out in every detail. However, a perusal of the original papers cannot but impress one with the conflicting results and opinions of the different authors. It is therefore with a view to summing up the conclusions of the different investigators and of putting forward certain reasons for the many discrepancies that this article is written.

Probably the first systematic work carried out on the growth problem was that of Okochi and Sato, *Journal* College of Engineering, Univ. of Tokio, 1920, vol. X, No. 3, who came to the following conclusions, using a dilatometric method of experimenting:

Oxidation does not play an important part in the growth.

Decomposition of cementite partially is responsible for growth.

The gas pressure within the metal is an important feature.

Following up the work of Outerbridge, *Journal* Franklin Institute, 1904, vol. 157, Carpenter and Rugan, *Journal* Iron and Steel Institute, 1909, No. 2 and 1911, No. 2, carried out exhaustive experiments with special irons in which silicon and other elements were allowed to vary, one at a time. Their conclusions were:

Growth is due largely to the oxidation of the silicoferrite.

Graphitization of the cementite is partially responsible for growth.

Phosphorus and especially manganese diminish the growth of gray cast iron.

A white iron will not grow so long as it remains white.

Dilatometric Test Results

In 1922 Kikuta, *Scientific Reports*, 1922, vol. 11, No. 1, published his results obtained by using a dilatometric method similar to that of Okochi and Sato. From leakage tests carried out to determine the evolution of gas from the specimen at different temperatures and after different heatings, he found that the leakage rate increased slightly with the temperature for the first 21 heats, and increased with the numbers of heatings up to about 60 heats. From these experiments he concluded that gas pressure cannot be regarded as being responsible for much of the growth. From the results of his dilatation experiments he concluded that:

Graphitization of cementite brings about a certain amount of growth during the first heating.

Indirect oxidation in which the oxide, when formed, fills the fissures and cavities during the A_1 transformation partially is responsible for growth.

The greater part of the expansion is due to the minute cavities or fissures formed by the irreversible expansion in different microportions of the specimen.

Curiously enough he states that the elongation observable at temperatures above A_1 is due to the presence of occluded gases, as conceived by Okochi and Sato. The oxidation theory of Carpenter and Rugan is untenable, he says.

Andrew and Hyman, *Journal* Iron and Steel institute, 1924, No. 1, using a method similar to that of Carpenter came to the following conclusions:

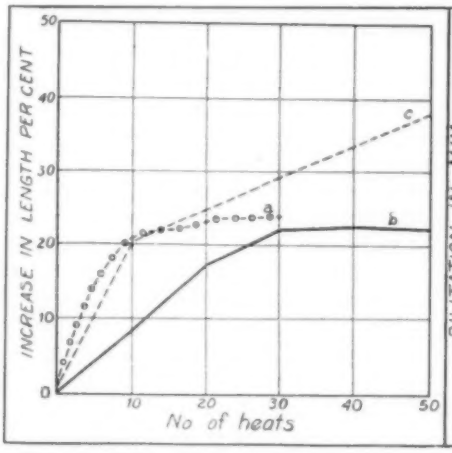
The growth of cast iron takes place in two stages. The first is the rapid stage, and is due to oxidation of the ferrite. The second, or slower stage is marked by a rapid oxidation of the free graphite, which is replaced by oxide material.

From their experiments on nickel iron in which the permanent growth was as pronounced as it was in the silicon irons, they suggested that the influence of such graphitizing elements as silicon, aluminum and nickel was due to their effect upon the form of graphite, which on account of their presence existed in the form of large and thick flakes. The penetration of gas through a large and thick flake would take place more easily than it would through a thin one.

The most recent work is that of

Work Is Notable

THIS article is abstracted from a paper presented at the Chicago convention of the American Foundrymen's association on behalf of the Institute of British Foundrymen. The author is doctor of science and professor of metallurgy, Royal Technical college, Glasgow, Scotland. Dr. Andrew's work on the growth of gray cast iron is especially notable.



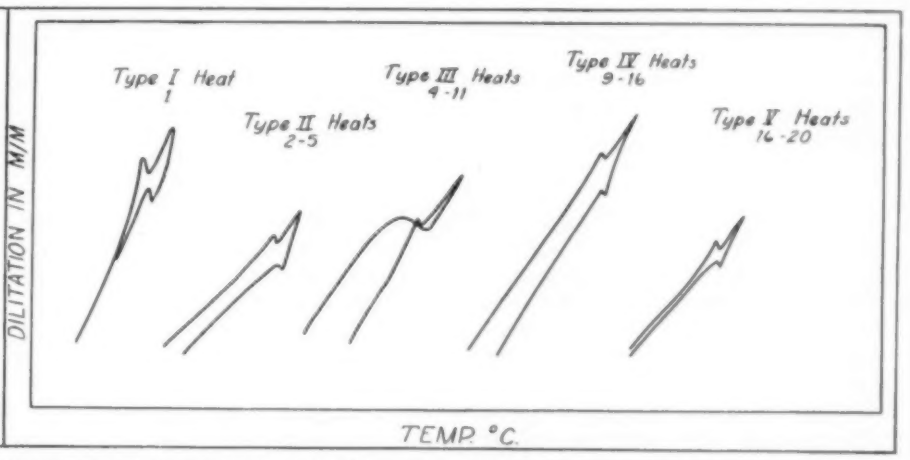


FIG. 1—CURVE COMPARING RESULTS OF CARPENTER AND RUGAN, PEARSON, AND ANDREW AND HYMAN. FIG. 2—HYPOTHETICAL FIGURES INDICATING GENERAL FORM OF CURVES FOR CAST IRON WITH 4 TO 4.5 PER CENT CARBON AND 1.5 PER CENT SILICON

Pearson, *Carnegie Memoirs*, Iron and Steel institute, 1926. This author, after carrying out experiments similar to those of Carpenter, supports the latter in most of his conclusions. He further confirms the work of Andrew and Hyman in that the form of the graphite flake influences the rate of growth. Andrew and Higgins, *Journal* Iron and Steel institute, 1925, No. 2, using a form of dilatometer different from that of the Japanese workers carried out a series of tests on irons which varied in manganese and phosphorus. Since the conditions under which these experiments were performed are peculiar to themselves this work will be dealt with later.

Draw Varying Conclusions

This brief summary of work done is sufficient to show that while certain conformity of viewpoint does exist, the different workers are by no means unanimous in their opinions.

Most of the investigators in this field agree that graphitization is responsible for a certain part of the growth. Moreover, the results of the many observers who have conducted growth experiments in vacuo all seem to point to the necessity of air or an oxidizing gas as being an instrumental factor. This is further substantiated by Pearson, who found that only a slight permanent expansion occurred after conducting the heating in an atmosphere of hydrogen.

Although the Japanese workers would seem to regard oxidation of the ferrite as a secondary factor, the experiments of Carpenter, Pearson, Andrew and Hyman strongly point to this reaction as being a primary factor. Further, Pearson, by using a carbon dioxide atmosphere in place of air, obtained much greater growth. In favor of the oxide theory may be cited the following proof:

The irons of Carpenter high in silicon eventually disintegrated. This is strong evidence of the formation of some bulky material such as iron or silicon oxide within the specimens. This worker along with Pearson, and Andrew and Hyman further found an increase in weight corresponding to the increase in volume. It is obvious that the only material that could be added in these experiments is oxygen. Pearson on separating the silicon from the silica in his treated specimens found that silicon became changed into silica as the number of heatings increased.

Andrew and Hyman found that after fifty heats certain of their irons showed a complete absence of carbon, each graphite flake being oxidized and its place taken by oxide of iron, which when separated and analyzed was found to have the composition Fe_2O_4.

The presence of oxide as a micro constituent was further confirmed by Andrew and Higgins.

That oxidation of the iron preceded oxidation of graphite was pointed out by Andrew and Hyman, who found that in the first rapid period of growth the carbon content fell little. However, when the second and less rapid growth stage was reached the graphite rapidly became oxidized as the heatings continued. Further during the initial stages of graphitic oxidation a decrease in weight of the specimens took place, which is further confirmation of this view.

The methods employed by different workers may be classified into two categories, namely, the method of heating and cooling the irons in a furnace and measuring the increase in length and diameter after each successive treatment, and secondly, that of successively heating and cooling the specimens in a dilatometer and measuring their increase in length through the temperature range. As an example of the first method Fig. 1 is a comparison between the determinations of Carpenter, Pearson, and Andrew and Hyman, the irons selected for this purpose being as follows:

	Total Carbon	Silicon	Manganese
Carpenter (a)	3.98	1.79	0.23
Pearson (b)	3.77	1.55	0.87
Andrew and Hyman (c)	3.33	1.31	0.58

An interesting feature with respect to the three curves is the extraordinary similarity between the curve of Carpenter and that of Andrew and Hyman. Both of these curves show the beginning of the second period of growth between the tenth and fifteenth heat, the amount of growth up to this stage being similar in both examples.

Examine Reactions

The only difference with respect to the two curves is that the curve of Andrew and Hyman shows the growth to take place continuously whereas in the example from Carpenter growth practically ceases after 30 heats. This difference may be accounted for by the fact that the specimen of Andrew and Hyman became badly oxidized on the surface after 30 heats, thus increasing the superficial volume.

The difference in character between the two curves just considered and that of Pearson is marked. In the example taken from Pearson the primary growth period continues to 30 heats.

The peculiar fuzziness of the graphite flakes during the period of growth, particularly in the earlier stages, has been commented upon by many, and usually has been considered to have been due to admixture of oxide particles with the graphite. This feature along with the fact that oxidation of the iron precedes that of the carbon merits consideration, and it might be interesting to examine some possible reactions to account for the phenomena.

According to Eastman, *Journal*, American Chemical society, 1922, at temperatures between 0 degrees Cent. and about 600 degrees Cent. the reaction

$$2CO = C + CO_2$$

will proceed from left to right. At temperatures above 600 degrees Cent. according to the ratio CO_2/CO the reaction may proceed from right to left.

Further, below 600 degrees Cent. with a certain CO_2/CO ratio the reaction.

$$3Fe+4CO=Fe_3O_4+4C$$

will also proceed from left to right, this reaction likewise being reversible, depending upon temperature and CO_2/CO ratio.

It is quite possible that at low temperatures oxygen of the air combines with the carbon to form CO_2, and that this immediately is reacted upon by the iron on raising the temperature with the formation of magnetic oxide and carbon monoxide according to the equation.

$$3Fe+4CO_2=Fe_3O_4+4CO$$

On lowering the temperature again, the reaction

$$3Fe+4CO_2=Fe_3O_4+4C$$

might take place, giving rise to the fuzzy carbon already referred to. According to this suggestion a certain amount of the graphite consumed by the air would be redeposited as free carbon on cooling, while Fe_3O_4 would at the same time continue to form. Further, the reaction

$$2CO = C + CO_2$$

might easily take place at the lower temperatures in presence of the catalyst iron and iron oxide.

Draws Curves

That the formation of Fe_3O_4 along with a certain deposition of carbon does take place, and that this reaction is moderately rapid is evidenced by the curves of Andrew and Higgins, which show an extraordinary and sudden expansion of the system begining at a temperature of 600 degrees Cent. after a certain number of heats. A hypothetical figure has been drawn, Fig. 2, which indicates the general form of the curves for a cast iron containing about 4.0 to 4.5 per cent carbon and 1.5 per cent silicon.

Curves drawn in this figure represent generally the type of curve obtained in the series of irons with varying manganese, the only difference be-

tween the different manganese contents being not in form but with respect to the position of the curve in the order of number of heats. For example, with the high manganese series the form III persisted for several heats, but was eventually followed by curves of the type of IV. A peculiar feature noted was that the heat preceding that which gave the large expansion on cooling invariably showed an excessively large coefficient of expansion during heating. Indeed, the variation in the coefficient of expansion during the different heatings was a noticeable feature of this work.

This in itself supports the contention of Kikuta who would appear to assume that the growth is largely brought about by abnormal expansions and contractions undergone by the different micro constituents. However, the author would suggest further that the large expansion following upon a marked and sudden expansion on the previous cooling may be due to the newly formed material such as Fe_3O_4 and possibly, in the earlier stages, deposited carbon, not being able to occupy their normal volume at the time of their formation. Upon heating up they are enabled to expand and so occupy their normal spacings.

The contraction sometimes met with at later heats would seem to be due to Fe_3O_4 segregating and occupying blow holes and the spaces left by the graphite. The results of Pearson, which show an increased growth in an atmosphere of CO_2 as compared with air, give further support to this contention. Up to the present it has been assumed that normal types of cast iron were being dealt with. Of the special irons Carpenter has shown that high manganese in the absence of high silicon considerably reduces the rate of growth. Andrew and Higgins found that, provided the silicon content was about 1.5 per cent, little difference was observed with a manganese content varying between 2.0 and 5.5 per cent. Indeed, manganese seemed to accelerate rather than reduce growth.

Carbides Break Down

A peculiar feature in the manganese irons was the sudden breakdown in patches of the manganese-iron-carbide. Micro examination showed that in the same specimen there often occurred patches of manganese-iron-carbide perfectly intact, while other patches had broken down completely into free carbon. When once the decomposition of the manganese carbide had been brought about, it was only to be expected that, manganese being a highly oxidizable element, growth would be accentuated, and this was a fact. The free manganese being in the nature of a decomposition product would be in an extremely fine state of division and most readily oxidized by the air. Phosphorus presents a more difficult problem, and in summing up their work Andrew and Higgins were unable to make any definite statement with respect to the action of phosphorus.

However, certain facts are borne out by their experiments, namely, that a phosphide-iron-carbon eutectic is more stable than the pure iron carbide eutectoid, it would seem as if the phosphorus prevented the carbide of iron from decomposing. That this is so is evidenced by the fact that with the lowest phosphorus iron selected for their experiments, which had a phosphorus content of 1.30 per cent, practically the whole of the combined carbon was graphitized during the first cooling. However, as the phosphorus content increased, the process of graphitization became slower. Another peculiar feature with respect to the higher phosphorus irons containing phosphorus from 2 to 4 per cent was the marked contraction which took place on soaking at 900 degrees Cent. This was found to be due to the phosphide of iron liquating and filling in the free spaces left by the graphite and those due to blowholes.

Phosphorus, although uncertain in its effects, would seem to slightly increase the growth of iron.

Growth on Heating

Viewing the effect of the different elements upon the growth of iron, it would seem that elements which accelerated the graphitization of the carbide such as silicon aluminum and nickel increased growth, while elements such as manganese in the absence of elements of the first class, chromium, and other carbide forming element, also carbide stabilizers such as sulphur, would tend to decrease the growth. In other words, it would seem that it is only those elements which will give an unmachinable white iron which will retard to any extent the rate or magnitude of growth.

With respect to what may be described as low temperature growth, the recent work of Higgins brings to light many interesting facts. His low temperature dilatation curves give one the impression that low temperature growth is due to the same phenomena as is high temperature growth. His curves show a marked variation in the coefficient of expansion, which corresponds with the same feature in the high temperature curves of Andrew and Higgins. His micrographs show conclusively that formation of oxide of iron takes place readily, and that it is this reaction which is instrumental chiefly in bringing about the expansion. That the greater part of the carbon remains unattacked is evident also from his photos, although a certain fuzziness along the graphite flakes points to the formation of Fe_3O_4 along with a deposition of carbon.

It must not be overlooked that the deposited carbon is the result of a high temperature reaction in which the graphite becomes oxidized, followed by a further reaction in which the CO or CO_2 again breaks down with deposition of carbon. The term high temperature reaction of course is used relatively.

Measurement Is Accurate

When the extraordinary heterogeniety of cast iron is taken into account, it becomes more remarkable to find such an extraordinary agreement between the results of Carpenter and Andrew and Hyman. In considering the factors involved in the growth, sight of the particular configuration of the micro constituents must not be lost. If, as in most cases, the type of section experimented with is in the form of a round bar, then the angle which the graphite flakes makes to the longitudinal direction of the bar must not be overlooked.

Supposing, for instance, that in one case the graphite flakes which have become filled with oxide material lie in a direction parallel to the length of the bar under test, and in another case that they all lie at right angles to the length. It is obvious that the expansion along the length and across the diameter will be different in the two cases. Whereas the total increase in volume would be the same in both cases, the measurement in the increment in diameter of the bar cannot be as accurate as one taken long the length.

This is in no way due to inaccuracies in actual measurement but rather to the fact that surface oxidation will have a greater effect upon the diameter than upon the length. The particular arrangement and size of the micro constituents will have an appreciable effect not only upon the magnitude but upon the rate of growth, and also upon the coefficient of expansion over the whole range of temperature employed.

It would seem quite evident that, as previously has been stated, no machinable iron can resist the powers that bring about its growth. The rate of growth may be retarded by the addi-

(*Concluded on Page* 975)

POWER CONVEYORS Handle LARGE MOLDS

Eastern Foundry Specializing in Gray Iron Castings Surfaced With Abrasive Materials Increases Production With Mechanical Equipment

APPLICATION of conveyors of various types to production foundries has made remarkable progress in recent years. Equipment utilizing gravity or some form of mechanical power has been developed by several manufacturers to handle molds, flasks, sand and other materials in the casting shop. As might be expected, the larger foundries such as the automobile shops have led in the application of mold conveyors and it is rather unexpected to find that probably two of the largest conveyor units, which carry 3 x 10-foot flasks, are installed in a foundry pouring about 40 tons daily.

Recently, the American Abrasive Metals Co., Irvington, N. J., completed the installation of considerable new equipment, including two large power driven mold conveyors, each carrying 20 flasks, 3 x 10 feet, and complete equipment for preparing and handling the sand. Since it is thought that the flasks are the largest carried on any power conveyor the installation is of unusual interest.

For over 13 years the American Abrasive Metals Co. has been making gray iron castings surfaced with abrasive materials. Stair treads are among the principal articles produced by that company, although in addition a great variety of abrasive surfaced castings are made. Included in the latter are elevator platforms, mine locomotive brake shoes and industrial floor plates. The Abrasive surface on the casting is secured by sprinkling a thin layer of ground carborundum or other abrasive material on the mold just before pouring, considerable skill being necessary in the application of the process. The mold then is poured with hot metal and the abrasive particles are picked up and form an integral part of the casting.

A general layout of the central portion of the foundry floor is shown in Fig. 5. This portion of the foundry is divided into two main bays, each about 30 feet wide and separated by a small central bay about 15 feet wide. The larger bays each contain a power mold conveyor unit and the smaller bay the shakeout station. The molding machines are shown at the left of the conveyor equipment in Fig. 5 and the pattern shop is located beyond the molding station, although not shown in the illustration. The

Fig. 1—The Abrasive Material Is Applied to the Drag Mold Just Before It Is Carried Around the Turn of the Conveyor

The molding floor is divided into two sections, each equipped with two, roller-ramming type, molding machines. Two machines make the copes and drags for one conveyor unit, the copes being made on one machine and the drags on the other. The machines are equipped with pattern boards which consist of soft pine boards mounted on machined iron frames. After the pattern board is placed on the machine, the standard 3 x 10-foot flask is set in place. While the flasks have been machined to secure accurate alignment, they rest on four adjustable pins which permit the correction of any inaccuracies.

Sand is delivered to the flask from storage bins above through spouts, and discharge gates, as shown in the elevation drawing at the right of Fig. 5. The two discharge gates, shown above the molding machine in Fig.2, are of the clam-shell type and are controlled by hand levers within easy reach of the operators. After the flask is filled the sand is rammed by the roller, which is 18 inches in diameter and weighs approximately 3000 pounds. The roller is operated by a pneumatic plunger and one trip across the mold and back completes the ramming operation. The time required for the heavy roller to ram the mold is less than one minute. The mold then is stripped from the pattern board by the action of four pins, which are operated pneumatically and lift the mold slowly and uniformly from the pattern board.

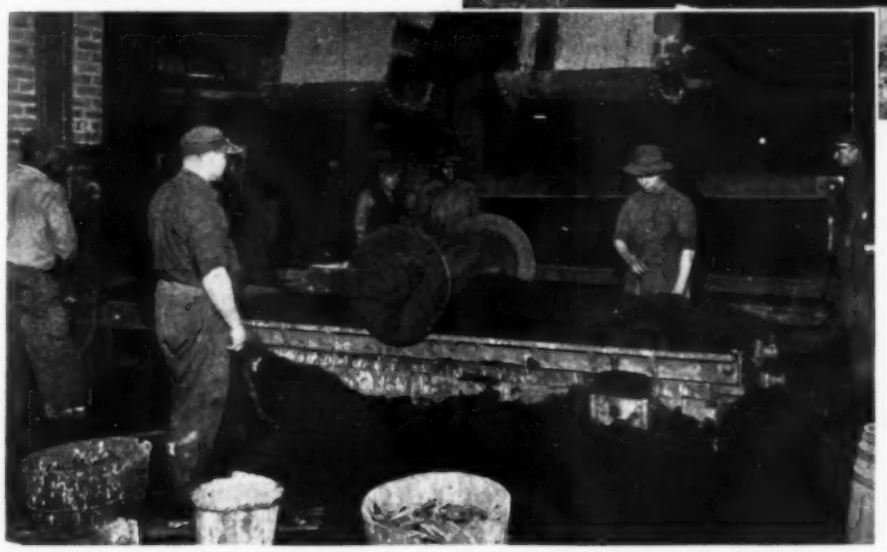


Fig. 2—The Sand Is Rammed by the Heavy Roller as It Travels the Length of the Flask and Back

The completed mold is picked up by a special carrier suspended from an overhead crane. The crane is controlled electrically by a push button mounted on the bail. As the molds are suspended from the crane, they are turned sideways, as may be noted in Fig. 3, inspected, touched up if necessary and then carried on an overhead trolley rail to the conveyor. The drags are placed on the conveyors at the stations indicated in Fig. 5.

Before following the mold through the various stages to the shakeout, the mechanical features of the conveyor unit will be considered. A general idea of the construction of the conveyor, which was designed and built by the Osborn Mfg. Co., Cleveland, may be gained from a study of Figs. 1, 4 and 6. The photograph reproduced in Fig. 6 shows one half of one unit assembled in the manufacturers plant for testing before it was shipped to the foundry. The design of the main conveyor has been worked out carefully to reduce wear on the various parts to a minimum and to keep the power consumption low. That the latter has been accomplished may be judged from the fact that a five horsepower motor drives one unit. The conveyor consists of a metal track upon which travels metal platforms or trucks of exceptionally large size. The conveyor trucks run on roller bearing castors with flanged rollers. The castors and the track are so arranged that when the truck is traveling around the curves at the ends of the conveyor, the load on the platform rests on the flanges of the castors. While the conveyor is traveling along the straight portions of the track, the weight is supported by the center of the castor. This is accomplished by guiding the castor onto a pair of rails as it leaves the turn at the end of the unit. At the turns the rails are omitted and the castors ride on the smooth steel plate, which is shown clearly in Fig. 6. Vertical guide rollers, which operate in a groove in the center of the track which is shown in Fig 1, hold the trucks in position and prevent any tendency of the castors to ride the rails on the straight runs.

Fig. 3—After Ramming, the Molds Are Lifted from the Machine, Tipped, Inspected and Patched Where Necessary

Each complete mold, as it rests on the conveyor platform, weighs about 6000 pounds, which means that the normal load of the full conveyor when in operation is approximately 50 tons. The conveyor carrying this heavy load is driven by an electric motor through worm gear, beveled gear and straight gear reduction to the large sprocket shown in Fig. 6. A heavy steel chain attached to the conveyor platforms rides on the two large cast iron sprockets. The sprocket wheel and gearing are covered to keep out dirt. The chain also is covered to prevent metal spilling on it. The turn made by each car at the end of the conveyor line is exceptionally short and the platform has been undercut on the inside to permit the platform to clear the housing, as may be noted in Fig. 6.

At present the conveyor is op-

Fig. 4—The Molds Are Closed and Poured Along One Side of the Conveyor

erated at a speed of about 5 feet per minute, although it is designed for various speeds up to 15 feet per minute. It moves on slowly but steadily and sets the pace for all interlocking operations. A certain amount of time is allotted for applying the abrasive coating, closing the cope and pouring and it is necessary for each crew to complete its work in the allotted time to prevent interference with the crew performing the next operation. For example, if some delay prevents the pouring crew from pouring the casting within the time allowed, the late pouring will mean insufficient cooling, which sometimes causes warping of the castings when they are piled for transfer to the cleaning department.

As the drag mold reaches the conveyor unit, the surface of the conveyor plate which will receive the mold is covered with sand to protect the plate from any runouts. Since the flasks have no bottom boards this puts two sand surfaces together. The weight of the mold is carried on end strips, as may be noted in Fig. 1.

Immediately after the drag mold is placed in position on the conveyor platform, the patented method of applying the abrasive material to the mold surface begins. This is an exceedingly delicate operation, requiring skill and experience on the part of the operators. If too much abrasive is placed at one point it will be carried along with the metal and will cause pockets and imperfections. If not enough abrasive is used at any one point, the casting is rejected upon inspection because of the imperfect surface. An adhesive coating is introduced to hold the abrasive in place during the pouring operation. Without the coating, the flowing metal tends to pick up most of the abrasive from the mold surface. The abrasive material is applied during the travel of the conveyor around the turn, a distance of approximately 24 feet.

After the drag mold has traveled around the turn of the conveyor and the abrasive metal has been placed in the mold, the cope is carried from the molding machine which is located adjacent to the drag machine, by the overhead trolley, and the mold is closed at the station indicated in Fig. 5. The molds then are moved to the pouring station.

Two cupolas are located on one

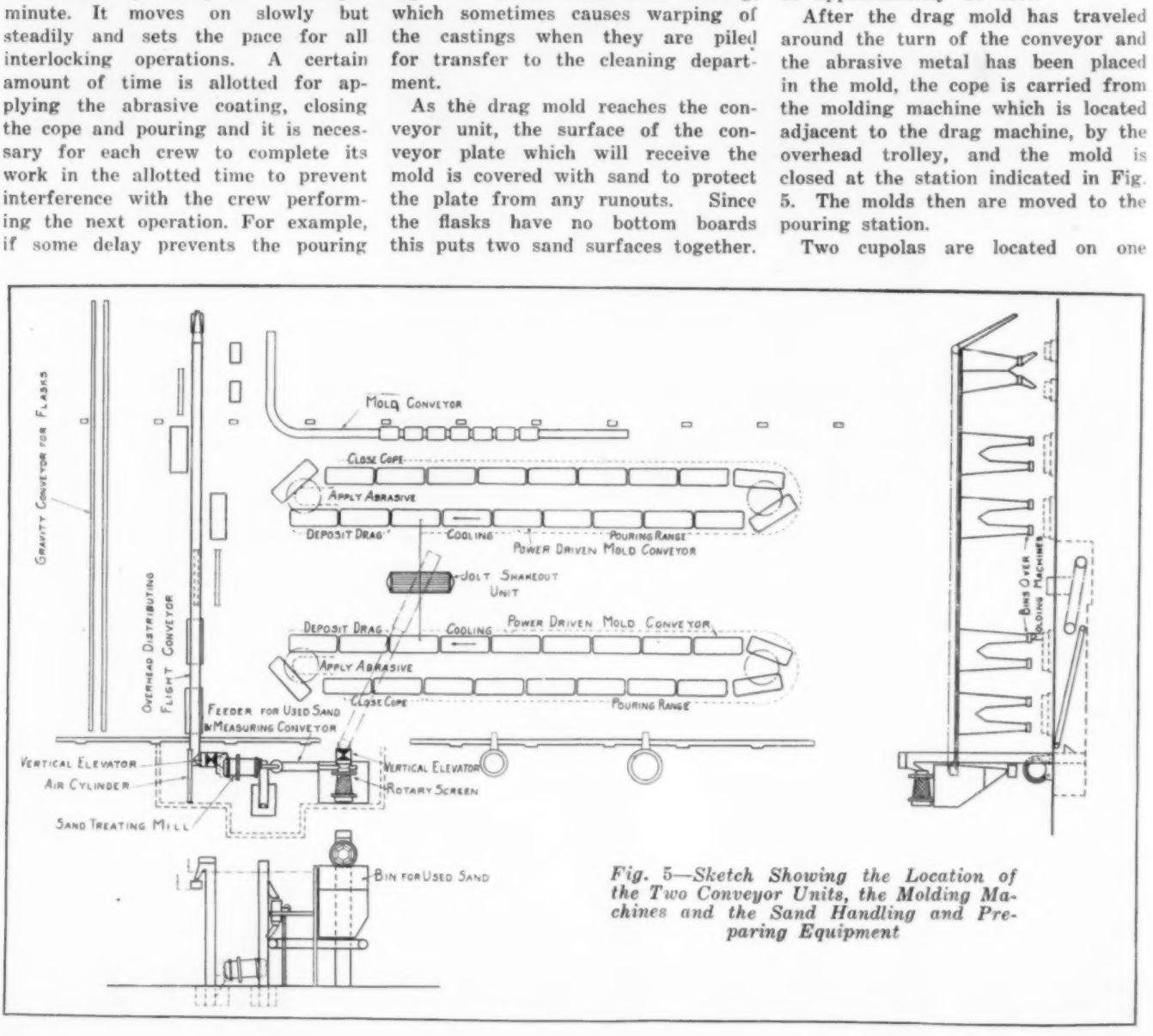


Fig. 5—Sketch Showing the Location of the Two Conveyor Units, the Molding Machines and the Sand Handling and Preparing Equipment

side of the foundry, as shown in the foreground of Fig. 5, and the metal is carried from the cupola to the mold in and is poured from small bull ladles. Each of the cupolas is used on alternate days. Pouring is continuous and barring accidents, the tap hole never is plugged during working hours. Eight ladles are used and two men are necessary for each ladle. These men catch their loads under the spout one after another in a continuous sequence. Timing has been developed to such a degree that the crews have little waiting at the cupola and yet there is no interval when a ladle is not provided to catch the metal from the spout. Metal is melted at the rate of about 5 tons an hour or 40 tons a day. Considering the distance traveled, 40 tons is just the amount of metal which may be handled readily by 16 men.

Conveyor Travels Slowly

As may be noted in Fig. 5, the cupolas are located nearer to one conveyor unit than the other. At first this might seem to be an objection, but the construction of the conveyor unit is such that little difficulty is encountered in carrying the metal to the more distant conveyor. The conveyor platforms were designed to allow a full foot between each two molds. Since the travel of the conveyor is slow, the pouring crew may step on the conveyor without difficulty or danger of spilling the metal and thus walk straight across to the second conveyor unit.

Pouring is directed by a head pourer, who marks the gates to be poured by one group with white clay. Since the molds are designed with a large number of down gates to insure hot metal at all points, it is not uncommon to have three or four pouring gangs at work on one mold. Frequently 16 pouring gates are used to the standard 3 x 10-foot mold. After pouring the castings are allowed to cool on the conveyor until they reach the shakeout station, shown between the two conveyor units in Fig. 5.

An auxiliary bay, located beyond the second conveyor unit and shown at the top of Fig. 5, is equipped for molding 30 x 60-inch molds. These molds are placed on a separate gravity conveyor, also shown in Fig. 5 and are carried parallel to the power conveyor unit, where they are poured When the castings have cooled sufficiently for handling, the molds are picked up by the pneumatic hoist, shown in the background of Fig. 4, and set on top of the molds on the power conveyor, which already have been poured. The molds then are carried on the power conveyor to the shakeout.

This is the first of two articles describing the manufacture of castings at the plant of the American Abrasive Metals Co. The second article describing the cleaning operations and the sand handling and preparing equipment will appear in an early issue.

THE EDITORS

Announce Schedule of A. F. A. Sessions

The tentative schedule of sessions for the Philadelphia meeting of the American Foundrymen's association has been announced. The program committee expects to place this convention on the same high plane of recent A. F. A. meetings which have added so greatly to the fund of information on foundry developments.

The session on management is being added to bring out a discussion of those problems which appeal to the executive interested in getting the best from his organization. The session on foundry costs will also be of value to this class of A. F. A. membership.

An innovation for the benefit of the practical foundrymen will be the short course on cupola operation. This undertaking, if shown to be of sufficient value will be expanded and short courses on the fundamentals of other phases of foundry practice will be held at future meetings.

The committee has in its organization of the program, considered the needs of all classes of members, including the executive, the metallurgical engineer, the mechanical engineer, the shop foreman.

Following a request, the coke specifications session is being organized to discuss the variations in coke specifications and terminology. Some foundrymen have reported that after having purchased by-product coke of a certain type and under certain specifications when of necessity, coke from a second manufacturer was used, changes in cupola operations and experimentation were necessary before best results were secured. The division of simplified practice of the department of commerce was requested to investigate this condition to see if specifications could be simplified and uniform methods of testing agreed upon. The session will offer the foundryman and the producer a chance to present their views on this subject.

Sessions of general interest, will be those on sand, costs, materials handling and apprentice training.

The tentative schedule of sessions follows:

Monday, May 14

Registration
Committee Meetings

Tuesday, May 15

9:30 a. m. Opening Meeting and Business Session
11:00 a. m. Nonferrous Metals
Steel Founding
Materials Handling
2:30 p. m. Foundry Coke.

Wednesday, May 16

10:00 a. m. Steel Metallurgy
Cast Iron
Foundry Management
12:30 p. m. Brass Founding—Round Table Discussion
2:30 p. m. Foundry Coke

Thursday, May 17

10:00 a. m. Apprentice Training
General Iron Founding
12:30 p. m. Malleable Iron—Round Table Discussion
2:30 p. m. Sand Control

Friday, May 18

10:30 a. m. Cast Iron
Malleable Iron

Fig. 6—One-half of the Mold Conveyor Assembled in the Manufacturer's Plant Before Shipment

The name of the F. J. Ryan & Co., Philadelphia, has been changed to Ryan, Scully & Co. A. C. Scully, who for a number of years has been identified with the firm will become treasurer.

How and Why in Brass Founding

By Charles Vickers

Skillful Alloying Is Necessary

We are sending two pieces of cast bronze bushing and would appreciate your advice as to the property of the piece marked "I" which sweats globules of lead when heated, as compared to the one marked "O" which does not sweat when heated, or at least shows much less tendency to sweat. This sweating of lead can be illustrated by heating the two pieces in a bunsen flame to around 800 degrees Fahr. The composition of the two samples are as follows: "I"; Copper 77.39 per cent; tin 9.42 per cent; lead 8.94 per cent; zinc 3.29 per cent; nickel present in small amount. "O"; Copper 79.43 per cent; tin 9.94 per cent; lead 10.08 per cent; zinc, none; nickel 0.14 per cent. "I" is melted in an open flame furnace; and "O" is melted in crucible furnace. We feel that the zinc content has something to do with the sweating. Therefore, what should be the maximum zinc content in a bronze for bushings of this composition? Will a bearing of 80-10-10 sweat lead if it runs hot in a machine, providing the alloy has been properly melted and poured at the correct temperature?

A careful inspection of the two pieces of bronze, within the limits of an ordinary magnifying glass, shows there is a difference between the two pieces. "O" is mixed better. Therefore, we believe the reason why the one sweats lead and the other does not is due to the fact of the one has been alloyed more skillfully than the other.

We suggest that samples of the two bronzes be submitted to an expert metallographist for examination, for it is only by having such scientific work done that guesswork can be eliminated. A proper interpretation of the results obtained will probably lead to a revision of the furnace practice as far as sample "I" is concerned. We discount the difference as being due either to the presence of zinc, or to the type of furnace used. We consider that 2 per cent would be sufficient amount of zinc to use although the alloy can be made without zinc. However, we do not advise this, in the case of "I".

There are different methods of making leaded alloys, but when zinc is not added in small amount, a suitable flux is a necessity in connection with the alloying. The melting has to be conducted skillfully to get a perfect blend of the metals composing the alloy. If the copper simply is melted, then the lead and tin added and the admixture stirred and poured immediately the mixture will be inferior, and the lead certainly will sweat on heating the alloy. Such an alloy will be inferior to another made in the same manner, but to which a small amount of zinc has been added, as the zinc will promote density, and the value of zinc in this connection is so well known that many founders never omit it from such alloys.

However the many makers of alloys of this class do not use zinc, and some think its presence harmful. The methods that have been adopted vary: One concern *processes* the lead, claiming to treat it when molten by passing hydrogen through it. What influence this process may have on the lead is somewhat difficult to determine. Whatever it may be there is a difference in behavior in the case of lead so treated, and lead not so treated, as the treated lead makes a better and stronger material; one that gives better service, and which as a consequence enjoys the confidence of a large number of users.

Gives Core Mixture

Kindly inform us what is the best core mixture we can use for making brass and cast iron bushings, 6 inches in diameter having a 1-inch core, 14 inches long. The brass eats into the core and we want to obtain a clean bore. The molds are cast horizontally.

We suggest an oil sand core and if many such bushings are to be made it would be economy to invest in a coremaking machine. Use the formula for mixing the sand supplied by the manufacturer of the machine, as such machines now have been in use long enough for the best mixtures of sand to be determined.

In the absence of a machine, use a good grade of sharp sand. Molding sand will not be needed in the mixture. Core oil or linseed oil can be used. The proportion of linseed oil to sand that will make a strong core is around one part of oil to 32 parts of the dry sand. In the case of proprietary core oils, take the advice of the manufacturer, who will know all about what is best, having gained his knowledge through experience. It will be necessary to protect the core with a skin which cannot be penetrated by the metal. Plumbago is good for this purpose, but it must be of the best grade and be laid on thick then polished.

The plumbago may be mixed with molasses water and made into paste which is then rubbed over the core using the fingers. It also can be mixed with silicate of soda water, or kerosene oil. Vent the cores thoroughly and take the usual precautions against getting the metal into the vents.

Leaks After Brazing

We are going to make castings for gasoline torches. We have found that after they are made and drilled they stand the test but after the tubes have been brazed in, they leak. How would you account for this? We would be glad to know a mixture that would be suitable for this work.

We will not attempt to account for the castings leaking after they are brazed when they are tight before this work was done, because we are ignorant of how the brazing is done, and of other factors in the case. On the face of it we should imagine the brazing was being carried out improperly and that possibly the temperature at which it is done is too high.

The following mixture has been extensively used for gasoline burners: Copper 79 per cent; zinc 15 per cent; lead 3 per cent; tin 3 per cent. To each hundred pounds of metal add 2 ounces of phosphor copper, and charge it in the bottom of the pot with the copper, using charcoal as a covering when melting, in the case of coke-fired crucible furnaces. Instead of new metal any good red brass ingot can be used and if it contains no phosphorus, it would be advisable to add about the amount suggested in the case of the new alloy previously given.

Chill Molds Effective *in Casting* Lead Textile Machine Parts

By E. R. McCuiston

PROBLEM of casting lead reels for pulling and transferring bleached cotton cloth through many operations in kiers, wash mills, acid squeezers and thence to the piling bins, has been greatly simplified through the adoption of a special cast-iron, chill mold shown in the accompanying illustrations. Lead is particularly adaptable for use in the textile industry through its high resistance to sulphuric acid and chlorine solutions commonly used in bleaching and finishing cloth.

For many years wood slats bolted to cast-iron heads were used for pulling cloth. They still are used in some places. Rapid disintegration of wood incident to alternate wet and dry conditions, has made this method expensive and as a result wood parts almost have disappeared. They were replaced by a cast-iron reel which in effect is a sheave with a V-groove. They were and are cast in halves, bolted together and placed on the shafts in any desired position. The cast-iron hub of the reel is bored to fit the shaft and is fitted with a set screw.

Cast iron yields rapidly to the attack of sulphuric acid and chlorine solutions. Corrosion and scale involve frequent replacement. Brass was tried and served its purpose admirably for a longer period than iron, but it also yielded to the powerful liquor and presented a pitted and scaly appearance. This rough surface increased the wear on the cloth and introduced the hazard of tearing it. Finally the problem was solved by making lead castings.

In the early experiments the castings were made in a fine grade of Kentucky sand with a dry-sand core to form the groove around the rim. Projecting ridges on the ring core cut the casting in two halves. The outside of the casting was clean but the metal seemed to soak into the core. A great deal of trouble was experienced in cleaning the groove without distorting the shape of the casting. Also the core did not fit closely and the casting was surrounded by fins. Necessity of machining the groove increased the cost to a prohibitive point.

The cast-iron, chill mold shown in Fig. 1 makes a perfect casting, requiring neither cleaning nor machine work. The mold is made in four parts, top, bottom and two semicircular parts to form the groove. A seat machined on the bottom section accurately locates the two groove sections while a male and female joint and a dowel pin on the top locates the cope section on the parts which form the groove in the casting and on the bottom. A thin steel strip placed in a slot in the drag and another in the cope serve to divide the mold into two parts and produce two separate half castings. The metal is poured through two gates diametrically opposite each other as may be noted in Fig. 1, where one gate is shown near the extreme top of the casting in the background while the second gate is near the bottom. Each gate is ¼ x 2½ inches and is tapered in such a manner that the cope may be lifted from the casting.

Gates are placed at the highest part of the mold to facilitate pouring the lead at a comparatively low temperature. Several ⅛-inch vent holes through the cope allow the air to escape and also serve to indicate that the mold is full.

Various temperatures while melting and pouring were tried before a satisfactory standard was established.

Satisfactory castings were poured with lead at a temperature of 800 degrees Fahr. at the furnace and 650 degrees at the time of pouring. Addition of lead gates to the ladle reduced the temperature quickly.

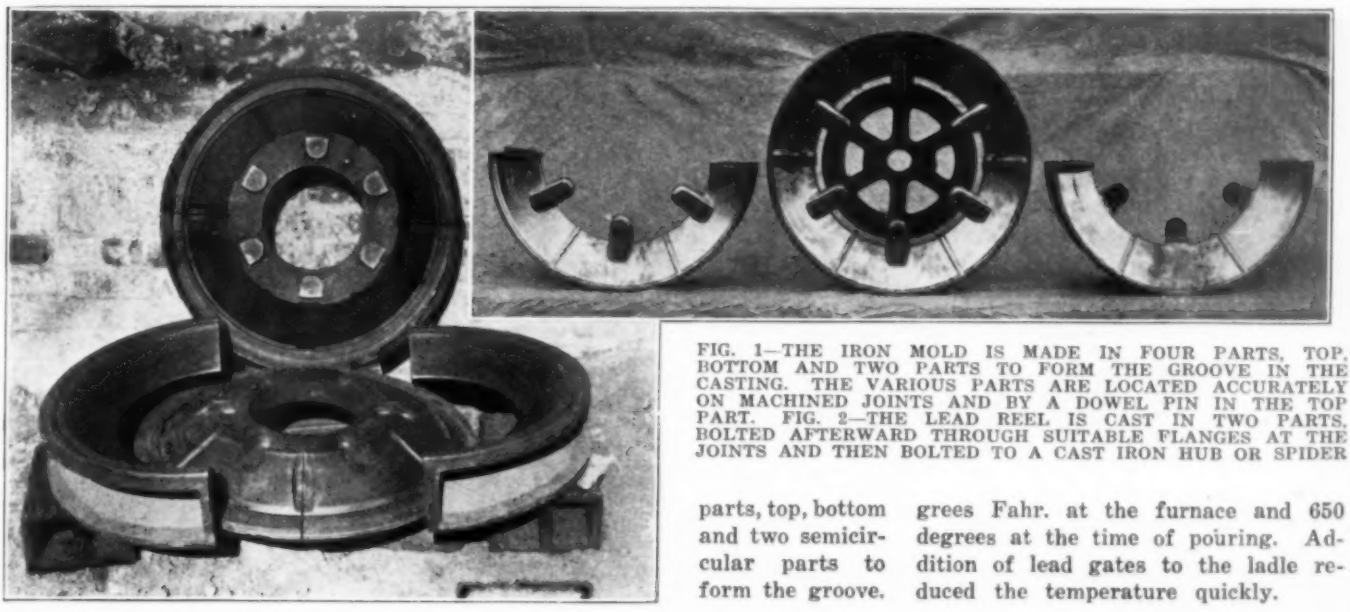


FIG. 1—THE IRON MOLD IS MADE IN FOUR PARTS, TOP, BOTTOM AND TWO PARTS TO FORM THE GROOVE IN THE CASTING. THE VARIOUS PARTS ARE LOCATED ACCURATELY ON MACHINED JOINTS AND BY A DOWEL PIN IN THE TOP PART. FIG. 2—THE LEAD REEL IS CAST IN TWO PARTS, BOLTED AFTERWARD THROUGH SUITABLE FLANGES AT THE JOINTS AND THEN BOLTED TO A CAST IRON HUB OR SPIDER

Bill Calculates Bricks in Melting Zone

By Pat Dwyer

FOR the past two months football has enjoyed front page space in the newspapers and practically has crowded all other news from the regular inside sport pages. According to the calculation of one of our best known statisticians if all these pages were collected and pressed into shingles enough material would be available to cover every farmer's house and barn in the states of Ohio, Indiana and Illinois. If the remainder was pressed into bricks, the supply would be ample to build a silo for 3-1/5 establishments out of each hundred. To present the comparison in a more familiar form if all the sport pages were rolled into suitable wads they could be used to stuff the broken window panes in every foundry in North America. If all the sport writers were laid end to end the world would be the gainer.

Skilled announcers have broadcast the games, play by play over the radio, for the benefit of a comparatively small number of enthusiasts, while millions of innocent victims either have had to sit in silence grimly gnawing their nails, or have had to listen to a meaningless jargon of yards won or lost, end runs, downs and penalties. 'Tis a hard world for the uncomplaining majority.

The astute person reading between the lines readily will gather from the foregoing that I am *not* a football enthusiast. In a more or less free country every man is entitled to his own opinion, and I resent the patronizing and pitying attitude assumed by followers of the game toward us common mortals who refuse to become excited over or even interested in the inconsequential details of an athletic struggle between two teams of young men whom we don't know, never knew and probably never will hear of again.

Up to the present, so far as I know, only one side of the story has been presented. Those interested in the game have had one long continuous inning. They have grabbed off all the front pages. They have monopolized all the conversation and have rah-rahed themselves into a condition where the outcome of a football game is regarded as more important than a presidential election. Even at a generous estimate I doubt if 5 per cent of the population of this country is interested in the game. What they lack in numbers they make up in enthusiasm and noise. The patience with which the other 95 per cent of the population tolerates this condition without a protest constitutes a remarkable tribute to their forbearance and generosity.

I have waited a long time for some free and independent member of a long suffering majority to lay a lance in rest to prick this blah-bubble of publicity inside which football has functioned in recent years. Proponents of the game for years have been allowed to shout themselves hoarse and none of us innocent bystanders has lifted a finger in protest, or even intimated ever so gently in proper sporting jargon that we considered the whole thing a mess of applesauce.

At this point football-rooter readers with their happy facility in coining imbecile war crys probably are chanting in regular one-two-three style:

"Ab-i-daba, Ab-i-daba, Throw him out—out—OUT!"

Shucks, that does not trouble me. I can hear a still greater crowd of sturdy supporters yelling:

"Attaboy kid. You tell 'em!"

Several weeks ago Bill and I had some business to attend in a city which necessitated a night's journey in either direction. We were through about noon and then the momentous question arose: How were we going to spend the intervening hours until our train left late at night?

Bill had the answer in his vest pocket in the shape of two tickets to a football game between teams from two of our leading institutions of learning. He is an enthusiastic follower of all forms of sport and brazenly admitted that the prospect of attending the game had been the principal factor in bringing him to the city. The temperature was down close to zero and I claimed that I knew forty better places to spend the afternoon than in an open stadium where we should freeze to death.

"The trouble with you" said Bill "is that you are dead from the feet up. Come with me, and get a thrill. Something that will convert the ice water in your veins into a stream of good red blood, coursing merrily to your tingling finger tips and to the ends of your crooked, yellow toes. Get in with a good, live bunch of howling enthusiasts, watch the gladiators buck the line, watch two teams of splendid young men engage in a homeric display of strength, speed, ingenuity, rapid thinking and close co-operation, and if that does not prompt you to throw your bonnet in the air, I'll eat it."

"Something seems to tell me" I said "that unless you have the digestion of a billy goat, you are due for a restless night on the sleeper. I have a good mind to wear a spiked helmet or a drum major's bearskin shako."

"I'm not worrying" said Bill. "You can wear a high silk Caroline hat or a

PEARY AT THE NORTH POLE? WELL, ALMOST

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

IRON AND STEEL ALLOYING MATERIALS

(*Continued from Data Sheet No.* 696)

Molybdenum

Ferromolybdenum, 50 to 60 per cent[3], containing less than 2 per cent carbon is used principally in the manufacture of medium carbon alloy steels. Molybdenum resembles platinum in physical appearance and possesses a peculiar lustre. It alloys readily with iron and resists most acids and chemicals to a marked degree.

Nickel

Nickel, 95 and 96 per cent[10], is used extensively in the iron and steel industry. Equilibrium diagrams indicate that each per cent of manganese lowers the melting point approximately 5 degrees Cent. and that 0.10 per cent carbon lowers the melting point about the same. The *A* and *D* grades both contain approximately 0.10 per cent carbon and the calculated melting points are shown in the table.

Silicon

Ferrosilicon, 15, 50, 60 and 75 per cent[2], is used in the manufacture of many grades of steel and iron as deoxidizers and alloying agents. The melting point curve for ferrosilicon shows two eutectics. These are at 20 per cent and 60 per cent, respectively, and it will be noted that the 50 per cent and 74 per cent ferrosilicon melt at the same temperature.

Ferrosilicon, 50 per cent, is brittle and slightly fibrous, the fracture is bright and has a steel gray color. The 50 per cent alloy will not disintegrate, but as the silicon approaches 55 per cent, disintegration becomes frequent. It is extremely soluble in steel and iron.

Titanium

Carbon free titanium, 25 per cent[1], analyzing 25.50 per cent titanium, 0.60 per cent manganese, 0.0 per cent carbon, 5.75 per cent aluminum, and 0.35 per cent silicon is a well-known deoxidizer and cleanser for both iron and steel. This alloy produced by the aluminothermic process is claimed to be free from carbon, and injurious and insoluble carbides. Because of this it melts and alloys readily with steel and iron.

Ferro carbon titanium, 15 per cent[4], analyzing 16 per cent titanium, 0.10 per cent manganese, 7.50 per cent carbon, 1.40 per cent silicon, 0.08 per cent sulphur, 0.05 per cent phosphorus and remainder iron is also a

(*Concluded on Data Sheet No.* 698)

IRON AND STEEL ALLOYING MATERIALS

(*Concluded from Data Sheet No.* 697)

well-known deoxidizer and cleanser for steel and iron. The carbide of titanium is at least as effective a deoxidizer as metallic titanium and is considerably cheaper in price.

Tungsten

Ferrotungsten, 80 per cent, is used principally in the manufacture of 14 to 18 per cent tungsten high-speed steel and 2 to 5 per cent tungsten magnet steels. Ferrotungsten is brittle and generally has a light steel gray color and extremely fine grain.

Uranium

Ferrouranium, 35 to 40 per cent[5], containing less than 1 per cent carbon and 2 per cent silicon is added to certain steels as a deoxidizing and alloying agent. Dr. George K. Burgess, bureau of standards, states that unlike zirconium and titanium, uranium appears to enter into solution in steel, that is, it is a true alloying addition. Uranium metal is white and takes a polish like iron. It may be filed easily and does not scratch glass. When the metal contains carbon it becomes hard and shows a crystalline fracture. This form is quite pyrophoric, readily giving sparks when scratched with a hard object, or rubbed with a piece of the same material.

Vanadium

Vanadium, 33 to 35 per cent[8], sometimes is considered the eutectic as some authorities give the eutectic formation at 32 per cent and others show it as high as 35 per cent vanadium.

Ferrovanadium[7] is used extensively in conjunction with chromium in the manufacture of steel. It is a granular steel gray alloy, is quite brittle and is soluble in steel and iron.

The melting point[9] primarily depends on the vanadium content in the alloy, the lowest melting point corresponds to a vanadium content of about 32.5 per cent in the alloy. For this same vanadium percentage, however, the melting point is considerably affected by the percentage of silicon. The 32.5 per cent alloy shows a melting point of 1400 to 1250 degrees Cent., the lowest melting point corresponding to the highest silicon content.

Sherlock Holmes fore-and-after for all I care."

Bill's confidence in a measure was contagious. Also I was mildy curious to see what there was in a game that would induce a crowd of people to sit in misery for an hour, risking death from exposure and pneumonia. At one time or another I had seen high school teams scrambling and fighting over a ball sometimes rolling in mud and the exhibition had struck me as a sad commentary on our so called civilization. In the present instance the game was to be played by highly cultured young university men and I reflected that undoubtedly it would be conducted on a higher plane and in a manner that would exemplify and reflect credit on their intellectual training.

I might have had more sense. Kipling said it long ago, when he referred to the colonel's lady and Judy O'Grady.

We took our seats in time for the preliminary exercises and if the temperature had been 80 or 90 degrees higher I should have enjoyed the panorama. Tiers on tiers of massed humanity rising on all four sides from an emerald field marked at regular intervals with white lines. Bill estimated the crowd at 60,000. Approximately half the number were ladies ranging in age from 15 to 50. Their brilliant head gear at a distance conveyed the impression of sloping hill sides covered with gorgeous masses of blooming wild flowers. The illusion was more pronounced at times during the progress of the game when momentary spasms of enthusiasm caused the mass to surge and sway after the manner of a billowy field, responding to the caress of a vagrant breeze.

As a result of the short walk before entering the stadium I felt fairly comfortable while the band of the visiting team marched and counter marched up and down the field. Before they finally blew the last blast and settled into their seats on their own side of the arena my interest had faded. The only man I envied was the drum major. I contrasted his fine knee high boots with my pitifull little Oxfords. As my ears began to congeal, I reflected bitterly that he was warm and snug under an immense bearskin topknot. Mentally, I consigned the inventor of the game to an eternity of vainly trying to kick a ball over the North pole—without his uniform.

In accordance with all the published reports of men who have perished from cold I rapidly calculated that if I was to freeze at the rate of one inch per minute, lineal measurement, I possibly might see the end of the game. Sober and chilly second thought showed me at least three variable factors that rendered the calculation worthless. First, I had no guarantee that 1 inch per minute is the recognized standard speed for freezing the human body. Second, for all I knew to the contrary, freezing might proceed from both ends simultaneously, thus reducing the time by one half. Third, conceivably the law of freezing paralleled the law which governs falling bodies, a steady acceleration of speed in direct ratio to the square of the distance or something like that.

I gave up the calculation in despair. The only pertinent fact remaining, the only point standing up straight and true, a lighthouse in a fog was that without doubt and in a short time I was due to be transmogrified into an icicle. Just as I was beginning to speculate vaguely on the probable differential in rates on a body shipped first class and one shipped in a refrigerator car, the first team trotted out on the field and spectators on our side of the field—with one exception—rose in applause.

RASSELING WITH APPLIED MATHEMATICS

The band played, the cheer leaders did their best to dislocate every bone and muscle in their bodies—a glorified arm slapping to keep warm—and the crowd on our side, with one notable exception as aforesaid, sang at the tops of their voices that forever and ever they would remain true to two more or less faded primary colors. Sis—Boom—Bah! Haha!

After a proper and dignified interval during which those who were lucky enough to have them, wrapped shawls and rugs around their lower extremities, the second team appeared and received an ovation only equalled by that accorded a relieving army with banners, marching through the gates of a sorely beleaguered town.

Several hundred ardent supporters dressed in white and disposed in the center of the grandstand to form the initial letter of their champion's college rose as one man, shouted their war cry and valiantly discharged a rattling volley of balloons tinted to match the heroes' uniforms. A noble and inspiring sight, me hearties! The only feature lacking in an otherwise hiliarious afternoon was a crowd of ubiquitous attendants hawking ice cream cones and floods of delicious ice cold drinks. B-r-r-r.

For half an hour I sat there and shivered, wondering what it was all about and why something did not happen. Also I could not help wondering why the game is known as football. To my certain knowledge the ball was only kicked three times. Once at the beginning of the game, once when a lad tried to kick it over the goal posts and only succeeded in hitting the cross bar, and once when a lad with a glimmer of common sense, realizing the utter futility of trying to get anywhere with the ball in the crook of his arm, hit it a kick that carried it half way down the field. I think they put him out of the game for committing such a glaring *faux pas*.

The whole gome was ruined by a fussy old bald headed gent in a pair of white breeches. Nothing suited him. Whenever the gang got in a clinch, instead of letting them fight it out among themselves and get on with the game, this hero stopped the show and insisted that the opposing teams line up opposite each other and start all over again. I rather expected at times he would slap some of them on the wrist and caution them to be little gentlemen. These constant interruptions must have been a sore trial to the patience of these high spirited young men. The exhibition reminded me of a nervous old woman learning to drive, stepping alternately on the accelerator and the brake.

At one time or another I have read that the field of sport needs cleaning up. For a beginning I suggest that the cleaning up committee starts with football. Cut out all the hampering rules and regulations. Roll up all the red tape in which it is strangled, make a bonfire of it and give the spectators a run for their money. Under present conditions the players are so harrassed and hampered by rules and penalties, brow beaten, bullied and bedevilled generally by coaches and referees that half the time apparently they don't know whether they are coming or going.

As I understand the game the object of each team is to carry the ball to the opposite end of the field.

Each team does its best to prevent the other from carrying out this laudable endeavor. All fair and simple so far. Then why in heaven's name can't the two teams be lined up in front of each other and at the crack of a gun be allowed to fight it out without interruption, either for a definite period, until one gang scores a goal, or until a majority of the players are exhausted or crippled? The latter contingency also would give the shivering substitutes a chance to get warm. Incidentally the spectators would be treated to a steady flow of action. Under present conditions the effect of watching a game is somewhat analogous to running up a flight of steps and unexpectedly finding every twelfth step missing. As our moving picture people have it, the continuity is broken.

Despite Bill's earnest protest that the best was yet to come, I unlimbered the old frozen frame and tottered out through the gate at the end of the first half. The best might be on the way, but I had no ambition to view it *a la* the *Skipper's Little Daughter*, lashed fast to a frozen mast.

While enjoying a light and refreshing draft of the weed that night before turning in I outlined for Bill's benefit some of my views on football. With his usual candor he declared I was looney and certainly he had no intention of trying to explain the fine points of a noble pastime to a gommach dumb enough to walk out when a game was only half over.

"According to your method" said Bill "the game would be nothing but a rough and tumble battle from beginning to end between two gangs of young barbarians. The first requisite in any struggle where brain is required as well as brawn is that a definite code of rules be adopted and observed by both sides. You are not interested in the game. Therefore, you do not either understand or appreciate the rules under which it is conducted. You are not alone. I know any number of men engaged in the foundry business who never take the trouble to familiarize themselves with the details.

"Recently I had a letter from a foundryman who wrote that the brick lining in a 21-inch cupola was badly burned at the melting zone for a distance of approximately 26 inches. The remainder of the brickwork was in good condition. He wanted to know if he would have to reline the entire cupola or could he just replace the brick in the burned area. Also how could he figure the number of bricks required and the size. The outside diameter of the shell was 30 inches.

"Of course I explained that he would only have to replace the burned part. However, I directed his attention to the fact that unless there is an angle iron inside the shell some place between the top of the tuyeres and the charging door, he would have to leave two piers or erect a wood prop at two opposite points to hold the upper lining in place after he removed the burned part. Otherwise the remainder of the lining will come sliding down after he removed the bricks between the bottom plate and the beginning of the good wall. The props may be removed after the new lining has been built up high enough at two points to engage the upper wall.

NEVER THE TWAIN SHALL MEET—IN PEACE

"The simplest, easiest and best method of calculating the size and number of bricks required is to write to the nearest foundry supply house to send a set of cupola blocks to fit a cupola 29 inches diameter inside the shell and with a required melting diameter of 21 inches. These blocks to extend upward 26 inches (or any other distance) above the bottom plate.

"In this connection, I directed his attention to the fact that a plastic lining material now is available that may be rammed like clay and is regarded favorably by many foundrymen. It dries into a hard refractory one piece lining.

"I said I should not be surprised to learn that the old lining is made of ordinary fire brick built on end with the side edges touching on the 21-inch circle, but with wide openings gaping between them at the back edge where they touch the steel shell of the cupola. These gaps have been filled with clay, but clay is not equal to brick in resisting high temperatures. Either cupola blocks, or side arch bricks, that is bricks with one edge thicker than the other, should be used for lining small cupolas.

"Assuming that for any reason he was limited to the use of ordinary fire brick, I told him he would need 75 bricks for the job, that is three tiers with 25 bricks to the tier. The ordinary brick measures 2½ x 4½ x 9 inches. The number is found arithmetically by multiplying the diameter 21 inches by the constant 3-1/7, to get the circumference, in this instance 64 inches. This circumference of 64 inches is divided by 2½, the thickness of a brick and the answer 25 indicates the number of bricks required.

"In the same manner when a standard fire brick is 9 inches in height, it is apparent that three bricks on end will extend a little above the required height of 26 inches. A little cutting and fitting will be required at the upper line.

"The practical shop man has a much simpler method for calculating the number of bricks required in a given circle. He chalks a ring on a bottom board or scratches it on the floor, sets a row of bricks up around it and counts them. If he has no bricks he uses wood blocks or uses a 2½-inch measure to step around the circle. If he only has one brick he shifts the desired number of times.

"The only tools required are a 2-foot rule, a piece of string with a nail at one end, and a piece of chalk or pencil at the other end, or a pair of temporary trammels made by driving two nails the radius of the circle apart, through a short lath or other suitable piece of wood. One nail serves as a center and the other nail is moved around to mark the ring."

"Bill" I said "all this talk of rings reminds me of the physics professor who asked one of his dumbells to define a transparent object. The young hero gallantly answered 'Anything you can see through.' 'Indeed!' says the ogre. 'Kindly cite an example.' 'A doughnut' brightly responded this chip of the old wood block!"

Investigates Characteristics of Steel Foundry Sands

By E. R. Young

STEEL foundry facing sands, omitting the natural bonded Eastern sands, ordinarily are synthetic mixtures, with a practically pure silica sand as a base. They correspond more closely to the core sand mixtures, made up from sharp sand used in iron and nonferrous foundries, than to the natural bonded molding sands. Therefore, a number of the generalizations made in foundry literature regarding molding sand do not apply to steel foundry conditions. This distinction is familiar to all steel foundrymen, but is not clear to all the investigators of foundry sand and may be worth emphasizing. For this same reason, namely that steel foundry molding and core sands are both synthetic mixtures, it is convenient to include both in a discussion of the ingredients of these mixtures.

In conducting experimental work seeking cleaner castings, the author decided that good quality steel foundry materials practically are adequate but that a better application of them is needed. He also has been impressed by the fact that the shop men know how to produce accurately a given result on a definite, difficult casting when studied as an individual problem and that the difficulties attributable to sand facing or cores frequently are the results of a practice which may not be well thought out or which may misapply the material to a specific job.

This article presents a survey of the common materials, their behavior described in shop terms, what may be expected and the results actually secured. It is thought perhaps the data present the basis for a common discussion of theories and observations and may lead to something worth while.

As stated, foundrymen not always are consistent in the use of materials in making up facing sand and core mixtures. Probably they are not sure of what to expect of these materials and what to secure from them. Therefore a tabulation of this nature even though incorrect in some of its details, if corrected, discussed and amplified, should help to clarify the knowledge of the materials listed, and aid in a more logical and efficient use of them.

The data given in this paper are not reports of research and of tests to determine new or unknown properties, but are tabulations of known properties of some of the common materials used in making synthetic molding and core sand mixtures. The accompanying table lists seven materials, exclusive of silica sand, and shows the relative green and dry bond of each, relative cost of each kind of bond, the nature of the material, as mineral, vegetable, volatile, combustible, etc., and the melting points of the solids when definite, temperature at which dry bond is destroyed, condition after baking or drying as to hardness, behavior under heat as to hardness, and nature or rapidity of collapse, tendency to absorb moisture, effect on refractoriness of the sand, effect on permeability of sand, effect on ease of removal of sand and casting surface resulting.

EDWARD R. Young, author of this article which was presented at the Chicago convention of the American Foundrymen's association, was born at Toledo, O. He was graduated from the engineering department of the University of Michigan, Ann Arbor, Mich., in 1915 and received the degree of master of science in engineering in 1917, after a year's work as holder of a fellowship in metallurgy. With the exception of a year spent on the metallurgical staff of the bureau of aircraft production, Mr. Young has for the past ten years been in the employ of the Detroit Steel Castings Co., Detroit, as assistant chemist, later as research metallurgist and salesman and for the past two years has occupied the position of research engineer.

Opinions Differ

Due to the difference of opinion on the best method of determining green and dry bond, and the necessity of standardizing all the factors involved there has been no attempt to give absolute values for these properties. However, the relative values are indicated.

There has been no attempt to go deeply into the physical or chemical properties of the materials, but only to give a description of them in simple terms, as of mineral or vegetable origin, combustible or incombustible and the per cent which forms gas, per cent which forms ash, together with the significant melting points. This may seem merely the repetition of commonly known facts, but the object is to try to describe accurately from the shop viewpoint the actual behavior of the materials in the preparation of molds and cores and the behavior when subjected to the action of molten metal in pouring. For that reason the table lists only these simple characteristics and goes more into detail regarding history of the material in the foundry.

To pass judgment on the behavior of materials and the results secured it is necessary to designate as closely as possible the type and cause of defects attributed to materials, as erosion or cutting, fusion, penetration, spalling or burning down, etc.

If it is possible to agree on what occurs and why, it will be much easier to correct difficulties. In talking with practical foundrymen, who from years

of observation are in a position to state what they believe occurs in a mold, it is apparent that all do not agree in their observations or have the same explanation for occurrences. Sometimes they reason from false assumptions regarding materials.

For example, in speaking of refractoriness and fusibility, is there actually any fusion of good materials or is a matter of penetration or erosion perhaps due to lack of baked bond? Why is it that when the sand has a fusion point well above the pouring temperature of the steel, the fire clay has a fusion point above the pouring temperature and the finished facing mix from these two materials also has the same high fusion point, the foundryman still has sand *burning in*? Does local fusion actually exist or is erosion or cutting of the sand surface and penetration of the metal into the surface layer of the sand due to that reason? If so, what is the relation of the cutting to the amount and durability of the dry sand bond or baked strength of the mold or core, and what is the relation to the fineness or closeness of the sand surface?

Some of these questions are discussed briefly following the explanatory remarks regarding the data in the accompanying table.

The green bond figures are based on data accumulated from shop tests. The relative values for amount of green bond are based on the bond of a 1 to 10 mixture by weight of the material with dried Ottawa sand, mixed by hand with the moisture content which gives highest green bond for that material. The bond of a good grade Ohio fireclay under these conditions (Lindstrom test with A. F. A. type bar—approximately 115 grams A. F. A. bond) is taken as a base and given unit value. The bond of each of the other materials was reduced to the same binder to sand ratio when necessary and referred to the base value given for fireclay.

The green bond of the materials having a value of about ½ is close to the green bond of the moistened sand alone, so it is doubtful if these materials add any effective green bond.

The green bond of the materials used for dry strength—strictly core binders—is not considered significant at the moisture content, 6 to 8 per cent, used for core sands.

The relative cost of green bond is based on the cost of bond secured from one pound of fireclay which is given unit value.

The dry bond figures are given with considerable hesitancy. Relative figures giving the range or order of magnitude are not as innocent as first appears, as it is necessary to have a definite value which can be used to determine the relative values. The data are from transverse tests with cores made under shop conditions, and therefore not as definite as desirable with relation to ramming and drying conditions. A check on the relative values of most of the materials was secured by a comparison with published data in researches on core binders. To get relative values it is necessary that the research cover two or more materials tested singly with sharp sand on the same kind of machine and that the results be expressed in the same units. From the work of H. L. Campbell relative figures on linseed oil and typical cereal binders were obtained and from the work of C. A. Hansen relative figures on linseed oil, rosin in solution and clay. The strength values were reduced to the basis of 1 of binder to 80 of sand by weight, which corresponds closely to 1 of linseed to 50 of sand by volume. Maximum figures, namely, those based on best drying time and temperature and best moisture content, were used.

It was found that the ratios of relative values of bond corresponded fairly well with the ratios shown by the author's tests, the actual strengths being higher for the cores tested under ideal conditions. On the strength of this check, the values for molasses have been included, although not checked by the work of others. The tests on rosin were made with the powdered material.

Linseed oil was taken as a base and 100 used to represent its dry bond value in the mixture given, 1 to 50 by volume, or 1 to 80 by weight. The

Characteristics of Materials Used As Binders

Material	Nature	Green Bond			Dry Bond										
		Melting Point Degrees Fahr.	Amt.*	Cost*	Amt.†	Cost†	Temp. Destroyed, Degrees Fahr.†	Effect on Refractoriness of Sand	Effect on Permeability of Sand	Condition After Drying	Tendency To Absorb Moisture	Behavior of Bond at High Temp. Hardness before Destruct'n	Nature of Collapse	Ease of Removal of Sand	Casting Surface Resulting
Fireclay	Mineral 5 to 10% volatile (combined water) Incombustible	3000 to 3100	1	1	2 to 5	45 to 75	900 to 1000	Lowers	Lowers	Fairly hard	Some	Hard	Slow	Hard	Fair
Silica Flour	Mineral Non-volatile Incombustible	3100	½	3.6				None	Lowers	Very hard	Some	Hard	Slow	Hard	Good
Cereal Binder	Vegetable Some volatile 99% combustible	Decomposes	4	3.5	60 to 70	48 to 56	500 to 600	Little	Lowers	Fairly hard	Some	Softens slightly	Gradual	Good	Fair
Dextrine	Vegetable Some volatile 99% combustible	Decomposes	2	7.7	50 to 60	62 to 72	500 to 600	Little	Lowers	Fairly hard Softer in center	Strong	Softens slightly	Gradual	Good	Fair
Molasses	Vegetable 30 to 35% volatile 95% volatile and combustible 5% ash	Liquid	½		40 to 50	36 to 45	400 to 500	Little (Ash may lower it)	Little	Hard Softer in center	Strong	Softens	Gradual	Good	Fair
Rosin	Vegetable 95% volatile and combustible 5% ash	Softens at 110 to 120			8 to 12	225 to 335	600 to 700	Little (Ash may lower it)	Little	Hard	Very little	Softens	Gradual	Good	Fair
Linseed Oil	Vegetable 95% volatile and combustible	Liquid			100	100	600 to 700	Little	Little	Very hard	Little	Hard	Rapid	Very good	Good

*Based on clay as 1.
†Based on linseed oil as 100.
‡Refers to pouring conditions not baking conditions. See text.

values of the other materials reduced to the same strength mixture, 1 to 80 by weight, were referred to linseed oil at 100 and their value on this basis determined by simple proportion. The stronger materials, higher figures, were given a range in the table of 10 per cent and the weaker materials, lower figures, a range of 20 per cent above and below the figure determined.

The relative cost of dry bond is based on the cost of the weight of binder equivalent to one pound of linseed oil, the cost of which is given a base value of 100. These figures also are determined by simple proportion.

The spread of the cost figures on some of the low strength binders is due to the 20 per cent plus or minus range used in fixing their bond values. The figures for some of the materials appear high, compared to linseed oil, but it must be remembered that seldom is the demand for strength from cores made from other materials as high or from oil cores. The impression of the high binder cost of oil sand cores is based on a high strength core.

Cost figures will of course vary with market prices and with localities. Assuming the bond values correct, these figures probably are representative of the binder costs in a middle western foundry at the present time.

Gives Temperatures

The temperatures given for destruction of dry bond strength refer to the destruction of the bond in the mold by the heat of the molten metal and not to burning of cores or molds in drying. These temperatures are, of course, approximate and are put 50 to 150 degrees Fahr. above the temperature at which the bond begins to seriously deteriorate in baking.

The hardness of the core or mold after drying will vary with the moisture content and the strength of the mix. It indicates the ability of cores to stand handling and to retain sharpness of outline. It also gives some indication of the resistance to the cutting action of the metal during pouring.

The behavior of bond at high temperatures as to hardness before destruction and nature or rapidity of collapse are not well known but plainly important properties, due to the effect on the resulting casting. They largely determine resistance to shrinkage, ease of removal of sand and surface secured. The practical foundryman's judgment regarding them is quite good, as shown by his choice of materials for various jobs. The properties listed are an interpretation of this judgment and of the known properties of the materials.

Data of this nature are likely to have as a background the practice prevailing at the foundry of the observer, and probably have been so influenced in this case. In this connection, the materials chosen for discussion were those with which the author was most familiar. The list of materials was not intended to be complete.

Seek Ease in Cleaning

The ease of removal of sand and the casting surface resulting will vary with the proportion of binder to sand and with the presence of other binders. Two or more binders often are used in the same mix and the effect of one may predominate. Also, the size of the sand section and of the metal section greatly influence the temperature reached by the sand and hence the final result.

There are several specific questions regarding use of materials which will be offered for discussion, some general deductions will be attempted, and some comments made and theories advanced on the happenings in molds and cores under certain conditions.

The questions which suggest themselves are:

1. Does rosin actually give a core flexibility or softness under heat?
2. Is there a cheaper material per unit bond than rosin which will accomplish the same purpose?
3. If rosin does give a core soft under heat, is it logical to use fireclay with rosin to give green bond?
4. Do rosin and oil actually give a better "peel" or a shiny surface on the casting? If so, should cores of this material be washed with silica wash?

Analysis of the tabulated properties shows that silica flour and fireclay are the two materials which contain the least volatile or combustible matter and the largest percentage of mineral matter. Therefore they undergo the least change at high temperatures and are the chief ingredients used with silica sand in molds and cores which will be raised to high temperature by heavy metal sections or long exposure to the metal in pouring. Both fireclay and silica flour are used in molds and usually only silica flour in cores for these severe conditions.

In addition to having a high mineral content, fireclay withstands the highest temperature of any of the binders before losing its bond and even then the collapse or loss of strength is gradual. Silica flour has no dry bond strength, but gives the impression of strength by hardness and compactness. When bonded with molasses water or oil a high content of silica flour, like fireclay, gives the sand the ability to retain its shape and its collapse is gradual, even after the oil or molasses bond is destroyed.

The other binders, unless accompanied by fireclay or a high silica flour ratio, are used for sand sections which will not reach a temperature sufficient to destroy the bond while the metal still is molten. Fireclay and silica flour, are the materials by which to judge progress and limitations in coping with hign sand temperatures.

Some of the properties of silica flour have been indicated. In high proportions it greatly decreases the permeability of the sand. It gives a sand mixture which can be compacted closely and made hard and impervious to metal. Such a compact core is difficult to remove in cleaning the casting. It appears to improve the ease of cleaning and the surface secured, when used in smaller amounts in oil bonded cores.

Silica flour does not tend to lower the fusion point of the sand as does fireclay. It only adds more finely divided material of the same fusion point. Fusion of a good sand-fireclay mix, seldom is secured, so it is doubtful if the beneficial effects of silica flour are due to any effect on the refractoriness of the mix. The improvement probably is due either to the slower collapse of the mold or core or to the greater closeness and hardness conferred by silica flour.

Has Good Strength

Fireclay, as stated, withstands the highest temperature of any of the binders before losing its bond. When the bond is destroyed, the change is evident by the easier erosion of the surface, but there is no collapse. Permeability cores (A. F. A. test specimens) of sand and fireclay mixtures, show considerable compressive strength after baking at 1600 degrees Fahr.—this runs about 40 per cent of the maximum strength. The hardness begins to decline at about 650 degrees Fahr. but still is satisfactory at 850 degrees Fahr. These properties explain the desirability of fireclay for bonding dry sand molds. It will withstand temperatures sufficiently high to permit the rapid and certain driving off of all gases, sometimes including the combined water of the clay itself, without collapsing. This no doubt is due to the large amount of incombustible or mineral matter in the fireclay. The bond or plasticity may be destroyed by driving off the combined moisture, but the bulk still is present in the sand mixture and the effect of compacting is evident from appearance.

However, when the bond is destroyed, the hardness declines and the mold surface is subject to erosion. Dr. Moldenke states that this decomposition of the clay bond is the cause of the cutting of the sand at the gate in green sand molds with the consequent washing of sand into the casting.

The improvement needed over present materials is a material which will retain its bond at high temperatures, or which will cause the sand mixture to glaze at high temperatures or surface harden.

The question of whether or not fusion of the materials in sand mixtures actually occurs in the steel foundry was mentioned earlier. As previously stated, it appears that the fusion point of the sand and clay mixture is well above the pouring temperature of the steel, 3000 to 3100 degrees Fahr., according to the somewhat uncertain cone tests, as compared to a maximum pouring temperature of 2850 to 2900 degrees Fahr. for open hearth steel from the ladle.

The sand-fireclay mixture used by the author is an impure silica-alumina mixture. By taking the lowest temperature at which a pure silica-alumina mixture begins to fuse, 1540 degrees Cent., or 2804 degrees Fahr., a temperature range somewhat lower than the high pouring temperature range is secured. However, the steel must furnish the heat to raise the temperature of the sand mix to the fusion point and it is doubtful if steel leaving the nozzle between 2850 and 2900 degrees Fahr. will flow through the gate, fill a cold mold, surround a core and raise the temperature of the core to 2800 degrees Fahr. Of course, the influence of pressure and the fact that the sand mix is a poor conductor of heat must be considered. However, the high temperature measurements are not absolutely certain especially the pouring temperatures within a range of about 50 degrees Fahr. This feature makes the result somewhat speculative.

The explanation more commonly given for cores seemingly fused and becoming difficult to remove is that the steel has penetrated the core, flowing in between the grains of sand, and that the hard core is a mixture of sand and steel. Observations of shop men support the view that the high silica flour-sand mixtures are most successful, in those cores surrounded by a heavy mass of metal.

Cores which are a mixture of steel and core material undoubtedly do occur and cannot well be questioned when supported by an analysis showing a high iron content.

However, the author recently observed some cores which were difficult to remove from large castings and which were called an example of metal penetrating the core. Upon examination the trouble seemed to be a case of vitrification of the material. It was observed that one of the pieces removed showed the contour of the original core which would not be expected if the metal penetrated the core from the sides. The density or specific gravity of the material was 2.3 compared to about 2.0 for clay-brick, and 7.8 for steel, and the pieces appeared like pieces of stone. This core was of a sand mixture containing clay. Another core of a silica flour sand mixture showed pieces like fragments of silica brick. It is assumed that the material at the high temperature and under the pressure which must have existed, baked or vitrified into a kind of firebrick in the first case and a silica brick in the second case.

Supposedly, steel foundries use a nonvitrifying clay, but inasmuch as silica sand may be made into a silica brick, it is assumed that all fireclays will vitrify somewhat under pressure and that if a really vitrifying type of clay had been used the core would have been still more difficult to remove.

But, brick can be broken and chipped readily enough even though hard. It is the fact that these cores are confined that makes them so difficult to remove. The thought suggests itself that if such cores could be made with a large vent or opening through the center or possibly a soft sand center and the metal kept out of these vents or openings, the cores though vitrified would be much easier to remove. This bears out a statement previously made that what we need is not usually higher melting point materials, but better application of those now in use.

New Device Dries Molds Electrically

By Robert Corey Deale

TWO kinds of dry-sand molds are encountered in foundry practice. In one, the mold is put into an oven and heated until the entire mass of sand has dried sufficiently. This procedure is more adaptable to small molds in which the casting weighs only a few pounds. It is effective, but slow and expensive, as the flask and the mass of molding sand must be heated through, while the layer of sand exposed to the washing action of the molten metal is all that it is really necessary to dry, if the mold is to be poured the same day. Large ovens are required, while, because of the inactive mass which must be heated to dry the interior of the mold properly, an unnecessary amount of time and heat is required.

The other type of dry sand mold, usually termed a *skin-dried* mold, employs some form of heat in the internal cavity of the mold, to dry a skin of sand about 1-inch thick over the whole interior surface of the mold, leaving the supporting sand moist or green. As this inner skin is the only portion of the mold exposed to the molten metal, this drying is fully as effective as the drying of the entire mold, while it is a much cheaper operation.

In the past, two methods of skin drying a mold have been employed. The first, used for large machine beds and similar heavy castings, makes use of a slow fire, fed by charcoal or wood, built directly in the mold cavity. This fire is permitted to burn until the mold has dried sufficiently. Under this practice ashes, sometimes are difficult to remove entirely, and they tend to become scattered throughout the mold, while the drying is uneven. Near the fire the sand may be burned, while the more remote portions of the mold may be insufficiently dried.

A later method employs some form of gasoline or kerosene torch. This is cleaner, but may cause uneveness in drying. Further, unless care is taken, the flame may burn the mold, particularly where there are thin sections of sand, while other portions may still be moist.

Electric heaters recently have been employed for skin drying. The even distribution of the heat possible with this form of equipment, is said to make possible uniform drying of the mold, with little or no chance of local burning.

The heater shown in Fig. 1 has been put on the market by the General Electric Co., Schenectady, N. Y. It is designed particularly for long or deep narrow molds. It is rated at 1250

watts, and consequently costs five cents per hour to operate, with electricity at four cents per kilowatt hour. These heaters may be used, one in each mold, for small molds, or several in one mold for the larger molds. An hour should be sufficient to skin dry a mold by this method when a heater of the proper capacity is used, so that it is possible to make molds, skin dry them, and pour them in the same half day.

The electric device consists of a helicoil, sheathwire unit cast into iron. The terminals are protected by a cast-iron cap with an insulated hole in it, through which lead wires may be brought. Asbestos lead wire is recommended for use with the unit to withstand heat.

As the electric unit will operate directly across the line voltage, any number required in a mold may be used. A suitable hook is provided at the terminal end by which the heater may be supported in deep molds. In shallow molds where the heater must be laid horizontally, it should be supported on metal blocks to prevent its touching the sand and thus causing the heater to over-heat and spoil the mold. It is also recommended that a sheet metal cover be placed over the mold during drying to speed up the process and reduce heat losses.

The new unit is rated 1250 watts at either 110 or 220 volts. It has a shipping weight of approximately 10 pounds and the following dimensions: Overall length, 21 inches; length of heating surface, 18 inches; width, 2¼ inches, and thickness, 1 inch.

The heater shown in Fig. 2 was made by Pratt & Whitney Co., Hartford, Conn., for use in its own foundry. It is rated at five kilowatts, and is built up of a number of 500 watt space heaters, such as are sold by a number of the large electrical manufacturers. These are mounted in a frame made of iron strips and angles.

This type of heater is adapted to general foundry conditions as it is designed to set in a mold without the use of any support. It prevents the heater elements from coming in contact with the sand, and also provides for a free circulation of the air around the heaters to carry the heat to the sand as directly as possible, giving a uniform drying condition and freedom from local overheating of the heaters. As the heating elements operate at a black heat, there is no chance of burning the mold.

For best operation, it is believed that it is desirable to use enough heater assemblies so that the mold cavity is nearly filled, and to regulate the length of time that the current is applied. The mounting is built so rigidly that the unit should give no trouble when it is subjected to the ordinary rough usage of a foundry.

Heaters of this type have been employed successfully by the Gleason Works, Rochester, N. Y., from which the design of the unit shown in Fig. 2 was adapted. The Gleason foundry has found that electrical skin drying obviates drying of the entire mold, and has adopted electric heaters for all its work. The company believes that the use of these heaters in the molds for all large castings is an important item in securing fine and accurate castings.

It has been suggested that a portable electric heater would be desirable for drying corners and weak spots in a mold which have been wet with molasses water or some similar binder to strengthen them. Such a heater should be light enough to handle easily, with a high temperature heating element, preferably with some form of reflector. Such a heater could be made with a reflector something like the smaller form of metal lamp shades, with a heat insulating handle, and a heat element of about one kilowatt capacity. Such a heater should have enough capacity to dry corners at 4 to 6 inches per minute.

Summarizes Data on Growth Test

(*Concluded from Page* 961)

tion of certain elements, but provided any iron continuously is heated and cooled for a large number of heats, growth invariably will take place. Even in the chromium irons experimented upon by Andrew and Hyman, the temper carbon which formed by decomposition of the chromium carbide gradually became replaced by oxide material, showing that growth was purely a question of degree and of time.

It would seem that the only way of preventing growth would be to deposit on the surface of the iron some metal or other substance which is impermeable to gases, thus preventing access of air to the graphite flakes and therefore to the interior of the casting. Even then graphitization of the combined carbon would still bring about a certain amount of permanent expansion which hardly could be prevented as graphitization occurs when the dissociation temperature is reached.

From the work of others and his own the author has come to the following conclusions respecting the underlying causes of growth in cast irons. Growth is brought about as follows:

By graphitization of combined carbon;

By percolation of air through the graphite flakes and channels in the iron bringing about oxidation of the ferrite, with the formation of Fe_2O_3, and probably finely deposited carbon occupying the interstices.

A certain amount of contraction eventually will result from oxidation of the graphite and deposited carbon, but this may be balanced by further and continuous oxidation of the ferrite;

Every time the iron is heated and cooled its structure will be changed due to the previous treatment, with the result that the coefficient of expansion will have altered. Further, the expansion of oxide material and direction in which this lies with respect to the length of the section em-

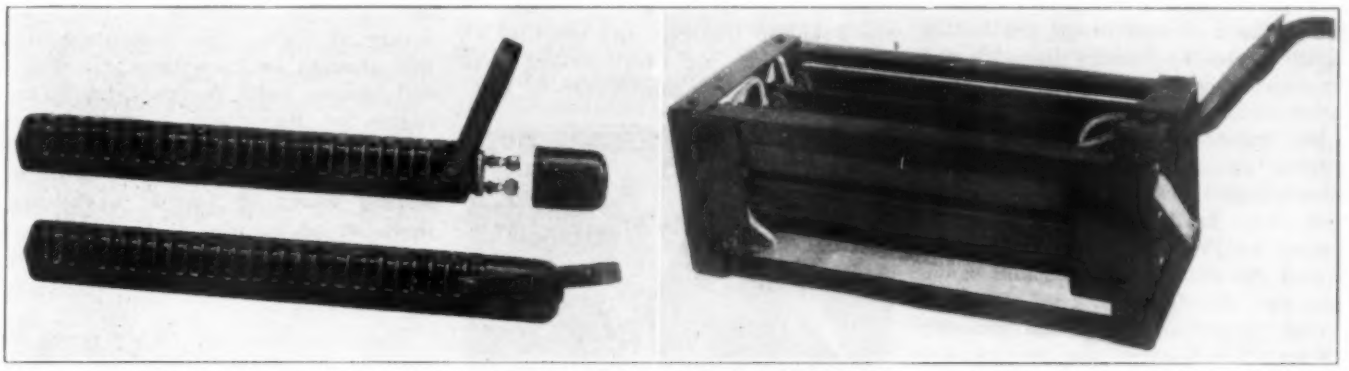


FIG. 1—UNIT HEATERS DESIGNED FOR LONG NARROW MOLDS OR DEEP POCKETS. FIG. 2—MULTIPLE UNITS OF REGULAR TYPE SPACE HEATERS, BUILT INTO BOX TYPE FRAME FINDS SERVICE IN LARGER MOLD CAVITIES

ployed will bring about a difference in total expansion at every heat, and will result in a breaking apart of the particles at certain areas, which in itself will cause growth in those sections.

The author does not think that occluded gases, or rather their physical effect, can bring about any permanent expansion. Oxidized gases in reacting with the iron or the carbon will of course have the same effect as similar gases added externally.

Outerbridge Awarded Gold Medal

ANNOUNCEMENT has been made that the board of directors of the American Foundrymen's association, acting upon recommendation of the board of awards, has decided to present to Alexander Ewing Outerbridge Jr., Philadelphia, the Wm. H. McFadden gold medal of the the American Foundrymen's associa- This award is made to Mr. Outerbridge in recognition of his many contributions to the advance of knowledge of cast iron metallurgy. Mr. Outerbridge was a pioneer in the application of science to the foundry industry and his researches have formed the basis for many developments of great value.

Mr. Outerbridge was born in Philadelphia on July 31, 1850, and was educated at the Episcopal academy of that city. In 1867 he was made assistant to Professor Fraser, who occupied the chair of physics and chemistry at the University of Pennsylvania. While acting in this capacity he attended lectures on physics and chemistry at the university. During 1868 he received an appointment as assistant in the assay laboratory of the United States mint at Philadelphia where he worked for eight years. During this period he spent considerable time at the University of Pennsylvania in research work on the spectroscopic analysis of gold, silver, and other metals.

In 1879 Mr. Outerbridge was sent to the New Orleans mint to establish an assay department. Returning to Philadelphia he was appointed metallurgist for A. Whitney & Sons Car Wheel Works, which position he held until 1888, when he became connected with William Sellers & Co. Inc., of the same city, as metallurgist, which position he still retains although he retired from active work at the age of 76.

In addition to his regular plant duties Mr. Outerbridge has been identified with the work of Franklin Institute of Philadelphia as professor of metallurgy and as a lecturer on industrial economics at the Wharton school of finance of the University of Pennsylvania. In the cast-iron field Mr. Outerbridge's research work on chilled cast iron, ferroalloys, mobility of molecules in cast iron, strengths of cast iron test bars as affected by tumbling and the growth of cast iron have been especially notable. His findings in these researches have been used as the basis for further researches of other workers. He was perhaps the first to see the value of X-rays in examination of castings, for in 1904 he showed examples of X-ray photographs of iron and steel and advocated its use in the examination of castings for defects.

For his original work in molecular physics of iron he was awarded the Elliott Cresson gold medal and John Scott legacy medal and premium of the Franklin Institute and the City of Philadelphia. Mr. Outerbridge has been an extensive contributor to technical magazines and technical associations, having contributed some of the first papers to the International Association of Testing Materials, the American Society for Testing Materials and the American Foundrymen's association.

ALEXANDER E. OUTERBRIDGE JR.

Mr. Outerbridge's contributions to American Foundrymen's association Transactions have been on the following subjects: Beneficial Effects of Adding High Grade Ferrosilicon to Cast Iron; Manganese and Silicon in the Foundry; Effect of Heat Treatment on Strength of White Iron Castings; Standard Test Bars for Cast Iron; Strength of White Iron Castings under Heat Treatment; Outerbridge Method of Detecting Mineral Oil and Rosin Oil in Other Oils.

It is singularly fitting that the presentation of this medal will be made at the meeting of the American Foundrymen's association in Philadelphia May 14-18. Mr. Outerbridge attended the organization meeting of the American Foundrymen's association in his own city in 1896.

Will Hold Foundry Meeting in Spain

Union Industrial Metalurgica, Barcelona, Spain, has organized a committee to arrange a foundry congress to be held at Barcelona during the spring of 1928. The committee also will arrange an inspection tour which will include visits to foundries in the region of Barcelona; blast furnaces of Sagunto, Valence; the works of Ste. Electro Metallurgique, Cordoue; leading works of Seville; works and precision laboratories of Madrid; arms foundry of Toledo and the iron and steel concerns of Bilbao and surrounding territory.

The committee will be composed of Joaquin de Miquel, president, Union Industrial Metalurgica, Barcelona; Jose Serrat y Bonastre, past president, Real Academia de Ciencias y Artes and assistant manager, Maquinista Terrestre y Maritima, Barcelona; Andres Oliva Lacoma, past president, Agrupation Catalane of the Associacion National de Ingenieros Industriales; Juan Mas Baga; Jose Canameras; Mateo Grau; Juan M. Espana and Alejandro Plana, general secretary, Union Industrial Metalurgica.

Research Group Holds Meeting and Dinner

The eighth regular monthly meeting of the Wisconsin Gray Iron Research group was held at the Republican house, Milwaukee, on Dec. 7. Dinner was served at 6:30 p. m. and was followed by an address by Arthur J. Tuscany, secretary of the Ohio State Foundrymen's association, Cleveland. Mr. Tuscany spoke on the work and results obtained by the Ohio organization.

The annual meeting of the Foundry Equipment Manufacturers association will be held at the Hotel Cleveland, Cleveland, on Feb. 7. H. Cole Estep, 1213 West Third street, Cleveland, is secretary.

Liquation Causes Scabs

Presents Interesting Theory on Probable Cause of a Form of Defect That Has Puzzled Foundrymen Making Ingot Molds

By David Rogers

JAMES A. Murphy's article in a recent issue of THE FOUNDRY on the tendency of soft coke to produce open, coarse grained iron has prompted the writer to give a brief account of his efforts to side step a defect which appears only in ingot molds made for the average steel plant.

The writer's experience is confined only to the rectangular molds used in the tin plate industry of southwest Wales, usually running from 12 to 14 inches square inside and about 5 feet 4 inches long with a 3-inch wall thickness. The mold generally is cast with a solid bottom, thus forming its own stool almost 5 inches thick. The defect takes the form of a slightly rough film with blacking on both sides of it, which generally appears on the corners of the core. Sometimes it is spread across the flat sides. These films vary in extent. Some oval patches measuring 2 x 3 inches generally come away fast to the core sand as the chunks are withdrawn. Some molds have films on all four inside corners and nearly all the way from top to bottom. These are difficult to remove because they are attached to the casting by numerous pin points and the steel maker objects to them because they come out with the bloom and cause trouble in the rolling mill.

One foundry which is part of a plant comprising rolling mills, open hearth furnaces and blast furnaces, casting from 15 to 20 of these molds per day, has had a great deal of trouble with films or shells as they are known locally. On one occasion pipes were rammed in the corners of some open top molds and then the corners were cooled with water. Molds that were water cooled showed no shell on the castings, but the remainder of the molds cast from the same heat and which were not water cooled, showed no shell either, so that experiment settled nothing.

Analysis of the iron revealed a considerable increase in the phosphorus content of these films as compared with the average 0.06 per cent in the straight cold pig iron from which the molds were cast.

Segregation of the last remaining liquid, coupled with the significant fact that the films when detached showed blacking on both sides, point to an unmistakable liquation effect after the mold is cast.

Experts to whom the trouble has been submitted have declared it to be due to *too much blacking, iron too hot, ramming too near the corebox, defective drying, vent holes in core arbor too small or too widely scattered.* Any foundryman troubled with shell can ring the changes on any and every possible variation of the molding procedure and still have shell trouble sometimes. This is an aggravating feature, but it indicates the search must be pursued along other lines. With a stabilized molding practice it is apparent we must look to the coke, iron and melting conditions for the correct solution of the problem.

Other Theories

The phosphorous segregation theory may be open to doubt, but no doubt exists that the films show blacking on both sides. This puts them outside the scab category and would seem to prove the liquation theory. Liquation must take place between the core and the wall of the casting and at some time while the iron is cooling down, but before the completion of the setting. In a 3-inch section the setting gradually takes place simultaneously from the inside and the outside. About 20 minutes after casting the walls are solid, say 1 inch thick, on both sides on all the plate. The corners which are hotter as a result of their position, will cool at a slower rate but the metal will congeal in the same way with some liquid perhaps becoming richer in phosphorus and remaining between the walls. No doubt the shell of slowly setting metal at the corners will be thinner than the metal in the remaining walls of the casting.

Some time before complete setting the metal will reach one of these points of arrest and recalescence accompanied by a certain expansion in volume which are stated to occur in gray cast iron. That such expansion does occur easily is proved by the fact that solid bottom ingot molds with arbor bolted to the base often will strip absolutely clean, leaving good cores standing. So far in my practice I only have noted this feature on molds stripped 12 to 14 hours after casting unless they have been poured with dull iron.

The metal in the casting after reaching the critical point in its cooling, expands somewhat and behaves just as four separate plates would behave if cut miter fashion at the corners. If they were heated to a high temperature they would push each other away from the core, thus leaving a slight clearance on all sides and at the corners.

Some of the last remaining liquid iron from between the inner and outer shells of congealing metal is injected into this space. Pressure on the metal is created by the expansion and the avenue of escape is provided by a series of hot spots caused by the burning of straw rope or other material in the makeup of the core. The intermittent or occasional character of the visitation is due to some predisposing cause in the pig iron aggravated by faulty cupola practice, excessive blast, insufficient coke between the charges, or a low bed causing a bessemerizing effect. Where it is considered the right thing to have the largest possible amount of iron melted with a minimum of coke, there you have the shell jinx at its happiest, because the slightest change, a holdup, a heavier pig or a softer coke brings iron into the zone of free oxygen.

Further proof of the theory that the shell is a liquation from the corners was noted during a visit to a foundry where the water cooling dodge was tried. Round ingot molds of about the same size and section never had any shells on them.

To Hold Convention

The fifth annual convention and exposition of the American Oil Burner association will be held at the Stevens hotel, Chicago, on April 3, 4 and 5, 1928. One of the features of the convention will be the report of the Oil Heating institute. The program will include addresses and papers by outstanding authorities on oil burning problems.

WHAT OTHERS ARE THINKING

Abstracts Selected from the World's Foundry Literature

Gives Molding Tips

Template Molding of Straight or Bent Pipe, and Fittings, by Jules Fivez, *La Revue de Fonderie Moderne*, Paris, July 10, 1927.

The result of the author's experience in this class of work is given, showing how he obtained the best results and explaining the reasons. Useful tips are given. The following examples accompanied by drawings are given: The first case is that of a straight pipe where the pattern and the core can be combined into one. The second case is more complicated and the pattern and core consist of several pieces. The next is the molding of an elbow where the core is rammed in the mold.

Gives Cast Iron Data

High Resistance Cast Iron—Study of the Elementary Factors of the Problem, by Prof. Albert Portevin. *Bulletin de l'Association Technique de Fonderie*, Paris, July, 1927.

This is the text of a lecture delivered by Professor Portevin before the French foundry association. The author explains the reasons why gray cast iron remains in constant use, owing to the possibility of obtaining it economically in the cupola, its property of well-filling the molds, its expansion when solidifying and its machining properties. The presence of graphite, which is necessary that cast iron may be machined, is detrimental to its resistance, and the problem consists in obtaining a resistant cast iron, while maintaining a total carbon content of at least 2 per cent and a graphite content of at least 1.5 per cent. Following certain considerations on the testing of cast iron, the author shows that a fine pearlitic structure is the most conducive to good physical properties, and that the graphite should exist in fine particles distributed uniformly in the mass.

The influence of the various factors which may be brought to bear to obtain the desired result is then reviewed: Chemical composition, particularly the influence of phosphorus, sulphur, manganese, silicon, carbon; the speed of solidification; the initial structure of the cast iron before going into the cupola; the heat treatment of the castings. The author arrives at the following conclusions.

To obtain the maximum resistance the chemical composition should be sulphur less than 0.15 per cent, phosphorus less than 0.3 per cent, manganese from 0.6 to 1.5 per cent, total carbon less than 2.8 per cent and silicon from 1.5 to 3.5 per cent. The process of manufacture must be controlled at the foundry, in the laboratory and by physical tests. Restrictions imposed on the sulphur and phosphorus contents necessitate the use of sufficiently pure raw materials. Carbon content depends on the operation of the cupola, and the main difficulty comes from the fact that the fuel is mixed with the charge.

Describes Malleable Melting

Malleable Cast Iron, by M. Guédras, *La Revue de Fonderie Moderne*, Paris, July 10, 1927.

This is the fourth article of the series. The author continues the discussion on the reverberatory furnace, showing the influence of the presence of silicon and manganese. The average losses are 30 to 50 per cent of the manganese put in the charge, 20 to 50 per cent of the silicon and 10 to 20 per cent of the carbon. Before adding the final additions it is recommended to take a sample of the metal and test it to see if it is sufficiently hot.

The author then mentions the use of the converter which he does not consider as a rational method. He deals at length on the electric furnace which he considers as the ideal means of production for malleable iron. Great care must be taken in selecting the scrap and turnings which make up the charges; they must be free from special metals such as chromium, tungsten and nickel. In addition to the charge of scrap, only a small amount of hematite ore and flux should be charged. The final content of carbon should be about 2.5 per cent, with 0.50 per cent silicon and 0.30 manganese. This metal will be superior in quality to that obtained in the cupola, states M. Guedras.

Gives Influence of Graphite

Improvement of the Qualities of Gray Cast Iron, by M. L. P. *La Revue de Fonderie Moderne*, Paris, Aug. 10, 1927.

The author supports the theory that graphite is formed by direct precipitation from the molten metal, and shows the importance of the sizes and division of graphite grains from the viewpoint of high tensile strength. He then indicates the influence on the qualities of cast iron of aluminum, titanium, nickel, chromium, molybdenum, sulphur, and cites certain methods used for adding such special products to the bath. The main portion of the article is a brief review of the various processes that have been evolved in recent years to obtain high-duty cast irons. The author mentions the Lanz process, the Weust oil-fired cupola, the Emmel-Thyssen process, the Corsalli process and the Dechesne process.

Investigate Nickel Effect

The influence of Nickel and Silicon on an Iron-Carbon Alloy, by Arthur B. Everest, T. Henry Turner and D. Hanson. *Foundry Trade Journal*, London, Oct. 13 and 20, 1927.

In performing this investigation on the influence of nickel and silicon on an iron-carbon alloy, the authors used a washed iron with 3.7 per cent total carbon; graphite, trace; silicon, 0.03 per cent; sulphur, 0.03 per cent, phosphorus, 0.016 per cent; manganese, nil. Silicon was added in the form of 97 per cent ferrosilicon and nickel in the form of shot containing beside nickel, some silicon, iron and carbon. Two bars, one in the form of a step having sections 1-inch, ½-inch, ¼-inch and ⅛-inch thick and the other cast against a chill were used in the tests. Specimens of the sections of the bars with varying amounts of silicon and nickel were examined microscopically to note the structure. Nickel graphitizes white cast iron, the graphite being in the form of fine flakes. It also causes the structure of pearlite to become finer and ultimately sorbitic. A qualitative indication of machinability was observed by the ease with which the specimens were cut with a hacksaw. Hardness determinations also were made as were determinations of density, resistance to corrosion and a study of the effect of heat treatment.

Discusses Steel Casting

Cast Steel, by Marcel Geudras. *La Revue de Fonderie Moderne*, Paris, Aug. 10. 1927.

In this short article the author differentiates the formation of piping from that of blowholes in steel castings. After having described the process of formation of the pipe in a steel ingot, he states that steel castings cannot be made without feeders, as is sometimes done with cast iron. Steel castings can easily be obtained without blowholes if molds are dried, the metal sufficiently deoxidized and kept still in the ladle that the gases may be eliminated. The sand in the molds should be permeable.

Presents Nickel Data

The Use of Nickel in Iron and Steel Foundries in the United States, by Jean Galibourg. *Bulletin de l'Association Technique de Fonderie*, Paris, July, 1927.

This work is the result of investigations made by the author during a stay in America in 1926. A brief review of the metallography of cast iron is first given, showing the modifications brought about by the addition of nickel in various proportions to low phosphorus cast iron used in America and on Continental iron. The properties resulting from the addition of nickel and nickel-chrome are then examined and compared, a similar comparison being made as regards additions of silicon. Results of tests and of practical applications obtained in America then are given.

The FOUNDRY Family Photograph Album

Upper Left

V. E. MINICH,
American Foundry Equipment Co.,
New York

Lower Left

C. R. MESSINGER,
Chain Belt Co.,
Milwaukee

Upper Right

FRED L. WOLF,
Ohio Brass Co.,
Mansfield, O.

Lower Right

GEN. OTTO FALK,
Falk Corp.,
Milwaukee

The Shakeout

DAN M. AVEY, Editor

PAT DWYER, Engineering Editor
FRANK G. STEINEBACH, Associate Editor

CHARLES VICKERS, Nonferrous Editor
EDWIN BREMER, Associate Editor

¶ Iron Reflects Progress

EARLY in the nineteenth century, the citizens of Baltimore viewed with alarm the possible reaction of the success of the Erie canal upon the future of their own rapidly growing city. Necessity caused the business men of the city to consider a means of linking Baltimore with the vast country to the west, which rapidly was being settled. In 1827 a charter was granted to the Baltimore & Ohio Railroad Co. and a year later sufficient funds had been raised to begin construction of the road. In 1830 the first division of the new railroad was completed, extending from Baltimore to Ellicott's Mills, a distance of 14 miles.

RECENTLY a huge pageant was held near Baltimore to celebrate the one hundredth anniversary of the Baltimore & Ohio. With displays taken from the archives of the company and gathered from other railroads, the exhibition showed the remarkable progress which has been made by American railroads in the short period of 100 years. Beginning with the early equipment which consisted of horse drawn cars and track built of iron strips laid on wooden stringers, the visitor was carried step by step through the remarkable changes which have taken place in the rail transportation facilities of the nation. Working reproductions of many early locomotives, such as Peter Cooper's "Tom Thumb" and the "York," the prize winning locomotive of 1830, illustrated the early attempts to use steam as the prime mover on American railroads.

THE centenary exhibition appropriately was called "The Fair of the Iron Horse," since iron formed the basis of all progress recorded. While there have been many contributing factors, the highly efficient transportation systems which serve all parts of the country today, would not have been possible unless similar progress had been made in the iron and steel industry. To the foundry industry must go a share of the glory of service, since castings have been used in practically all departments of railroad work for the past hundred years. As locomotives have increased in size, power and speed, as the demands placed on the track materials have developed tremendously and the luxuries of passenger travel have grown, the foundry industry constantly has increased the quality of castings made for railway service.

¶ Keeping Good Books

SAFETY in chipping, grinding and pouring operations in the foundry requires goggles for the best protection of the eyes of the workmen. However, much difficulty has been met in persuading the men to wear goggles. In many cases the men only wear them because the rule is wear goggles or lose your job. It seems foolish that some men will not wear them for their own protection without compulsion, but such is the situation. The excuses offered for not wearing their goggles are many and varied.

HOWEVER, the excuse many times offered is that a man cannot see with goggles due to double reflection or blurred vision. Some complain they suffer from headaches. At first glance, such statements seem exaggerated especially when it is considered that the lenses are plain glass. Nevertheless, the statements may be true. Men with slightly defective vision are troubled with double or blurred impressions when they wear goggles. This is exceedingly annoying and hence they remove their protectors at the first opportunity.

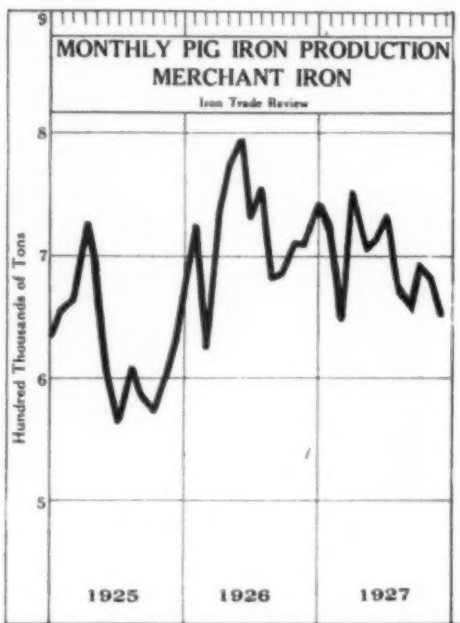
THE remedy for cases of this type is to have the men's eyes examined by a competent doctor or optometrist and have special lenses ground to correct the defects. This procedure has been tried many times with favorable results. Once the defective vision is corrected, the men experience no difficulty when wearing their goggles. Consequently, they do not need to be urged or compelled to wear them. Other factors that will assist in preventing complaints are a correct fit, and the example set by the foremen, superintendents and manager in wearing their goggles in locations where it is imperative that the men must. Nose contours and brow formations are not alike, therefore, each pair of goggles should be fitted to the face of the man to wear it.

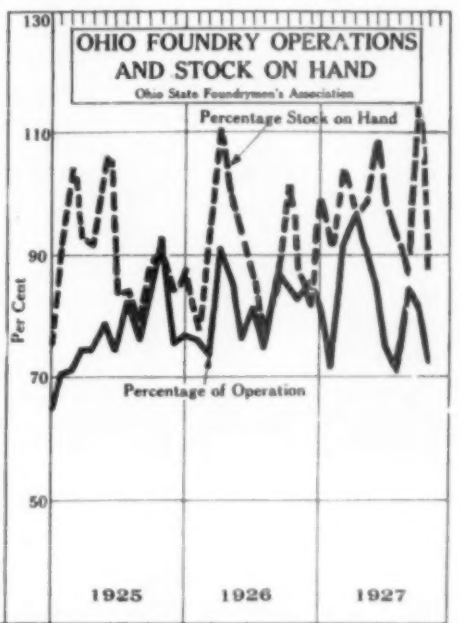
Trade Trends in Tabloid

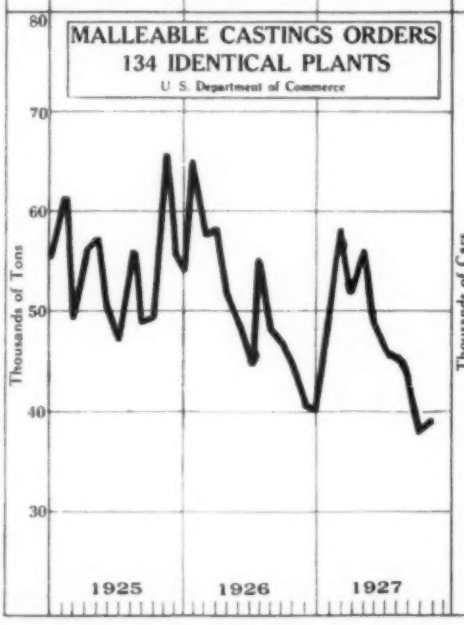
LITTLE change is noted in the state of foundry operations, which has been at low ebb for the past thirty days. This condition is expected to carry over until after the first of the year. Business is better among jobbing shops than in various specialty lines. Automotive work is expected to pick up by the first of January and a record year is predicted. Railway buying still is at a low point, the new car totals for the past three months all being below 1000 cars, while unfilled orders for locomotives are at the lowest figure noted in two years past. However, retail business is booming, crop reports indicate an increased buying power in the rural sections and building construction is expected to advance after Jan. 1. Foundries are buying little iron for first quarter delivery. Blast furnace production for November, according to statistics in *Iron Trade Review*, was the lowest since August, 1925. The November total of all classes of pig iron produced was 2,661,863 tons, compared with 2,812,015 tons for October. Merchant iron output during the past month was 652,237 tons, compared with 688,880 tons for October. Average monthly prices for nonferrous metals based on New York quotations in *Daily Metal Trade*, follow: Casting copper, 13.241c; electrolytic copper, 13.570c; Straits tin, 57.678c; lead, 6.268c; antimony, 10.777c; aluminum, 24.756c. Zinc averaged 5.745c, E. St. Louis, Ill.

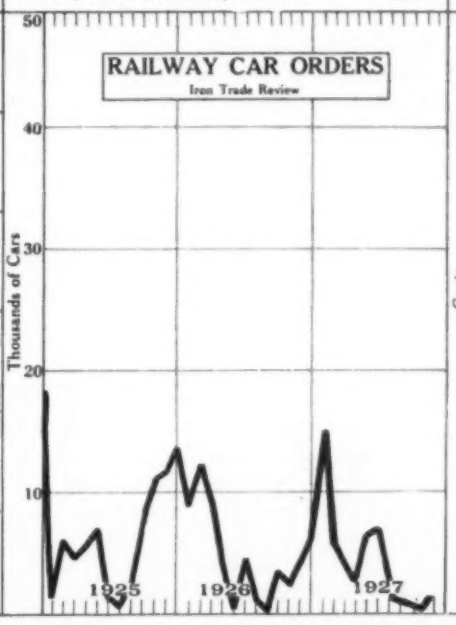
RAW MATERIAL PRICES
Dec. 7, 1927

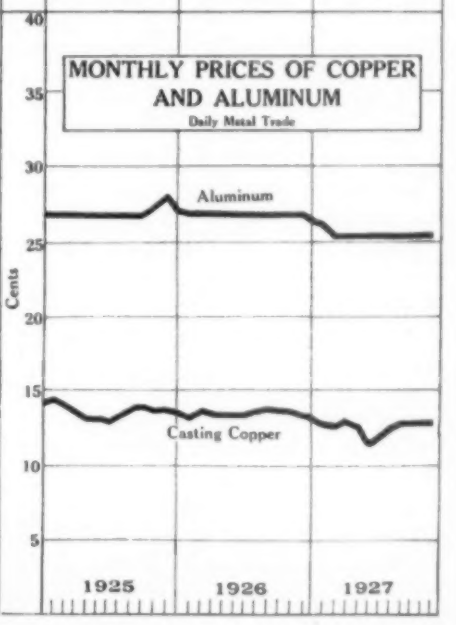
Iron	
No. 2 foundry, Valley	$17.25 to 17.50
No. 2 southern, Birmingham	16.00
No. 2 foundry, Chicago	18.50
No. 2 foundry, Philadelphia	19.76 to 20.76
No. 2 foundry, Buffalo	17.00
Basic, Valley	17.75 to 18.00
Basic, Buffalo	16.50 to 17.00
Malleable, Chicago	18.50
Malleable, Buffalo	17.50
Coke	
Connellsville foundry coke	$3.65 to 4.75
Wise county foundry coke	4.00 to 5.00
Scrap	
Heavy melting steel, Valley	$14.50 to 14.75
Heavy melting steel, Pitts	14.50 to 15.00
Heavy melting steel, Chicago	11.75 to 12.25
Stove plate, Chicago	12.00 to 12.50
No. 1 cast, New York	13.50 to 14.00
No. 1 cast, Chicago	14.00 to 14.50
No. 1 cast, Philadelphia	16.50 to 17.00
No. 1 cast, Pittsburgh	14.50 to 15.00
No. 1 cast, Birmingham	14.00 to 14.50
No. 1 cast, Buffalo	11.50 to 12.00
Car wheels, iron, Pittsburgh	14.00 to 14.50
Car wheels, iron, Chicago	13.50 to 14.00
Railroad malleable, Chicago	12.50 to 13.00
Agricultural Mal., Chicago	11.75 to 12.25
Malleable, Buffalo	13.50 to 14.00
Railroad malleable, Pitts	14.00 to 14.50
Nonferrous Metals.	**Cents per pound**
Casting copper, refinery	13.87½
Electro copper, producers	14.07½ to 14.12½
Straits tin	59.25
Lead, New York	6.60
Antimony, New York	11.50
Nickel, electro	39.00
Aluminum, No. 12, producers	23.50
Aluminum, No. 12, remelt	17.00 to 18.00
Zinc, East St. Louis, Ill	5.85











Comings and Goings of Foundrymen

A E. GIBSON recently was elected president and treasurer of the Fulton Foundry & Machine Co., Cleveland. Previous to his appointment as president, he held the office of vice president for 18 months. Before his association with the Fulton company, he was connected with the Wellman-Seaver-Morgan Co., Cleveland, for 17 years, the last five of which were in the capacity of general superintendent of the Cleve-

ARTHUR E. GIBSON

land and Akron works of the firm. G. W. Burrell was elected vice president of the Fulton Foundry & Machine Co., and Fred Watson, secretary.

Charles E. Attwood has been elected president of the Attwood Brass Works, Grand Rapids, Mich., succeeding the late Charles F. Attwood.

Richard G. Clark Jr. recently was elected vice president of the Eagan-Johnson Steel & Iron Co., Crum Lynne, Pa. Robert C. Lea was elected secretary and treasurer.

A. J. Copeland, for the past 12 years purchasing agent of the Industrial Works, Bay City, Mich., has been made assistant treasurer of the Industrial Brownhoist Corp., Bay City.

William J. Vodick will manage the new Detroit plant of the National Porcelain Enameling & Foundry Co. He is said to have enameled the first porcelain-enameled bath tub in this country.

Walter E. Nachtigal, formerly foundry superintendent, Crucible Steel Casting Co., Cleveland, has been made sales engineer of the Republic Carbon Co., Niagara Falls, N. Y. He was graduated from the Case School of Applied Science, Cleveland.

George E. Bean, general manager, Vulcan Iron Works, New Britian, Conn., also has been made general manager of the Malleable Iron Works located in that city. Frank Miller, formerly superintendent, Malleable Iron Works now is assistant general manager of the Eastern Malleable Iron Works, Naugatuck, Conn.

William H. Woodin, president, American Car & Foundry Co., New York, has been elected president of the American Locomotive Co., to succeed Frederick F. Fitzpatrick who died on Nov. 16. Mr. Woodin previously had been president of the Locomotive company from Dec. 3, 1925 to May 14, 1926 and then became chairman of the firm.

H. A. Jahraus, formerly mechanical engineer, Chisholm-Moore Mfg. Co., Cleveland, has resigned to engage in consulting work, specializing in material handling, problems and equipment of metallurgical and metalworking plants. His office will be at 1878 Haldane road, Cleveland.

Melmoth To Present Exchange Paper

The council of the Institute of British Foundrymen has selected F. A. Melmoth, the well known British steel foundry metallurgist, to present the 1928 Institute of British Foundrymen's exchange paper at the meeting of the American Foundrymen's association which is to be held in Philadelphia during the week of May 14, 1928. The title of his paper will be "Variables in Steel Foundry Practice".

Mr. Melmoth, who is a native of Sheffield, England, received his technical education at Sheffield university in the department of applied science. For his work there he was awarded an associateship in metallurgy with the Mappin medal of honor in 1913. His early works experience was gained at Brown Bayleys Steel Works Ltd., Sheffield, the latter few years of which were spent in the research department and in practical steel production by open hearth and electric methods.

Mr. Melmoth later specialized on steel foundry production with firms in the south of England. He was appointed steel maker and metallurgist to Lake and Elliot Ltd., Braintree, and coincidently served with the National Steel Foundry Ltd. of Scotland in a consulting capacity.

F. A. MELMOTH

Following this work he was given full charge of the foundry of the plant of Lake and Elliot Ltd. when he obtained experience in management of the production of steel, malleable and gray iron castings.

Two years ago Mr. Melmoth was appointed to his present position as manager of the steel foundry of Thos. Firth and Sons Ltd. of Sheffield.

Shows Shipments

Illinois shipped 53,734 tons of fluorspar from its mines in 1926 of which the steel industry took 45,328 tons or 84.35 per cent and the foundry industry 1854 tons or 3.45 per cent.

In 1925, 511,445 warm air furnaces valued at $47,423,130 were manufactured according to a bulletin issued by the bureau of census.

Obituary

W. L. Belknap, treasurer and general manager, Belknap Mfg. Co., Bridgeport, Conn., died recently.

Emil Guenther, founder of the Philadelphia Foundry & Machine Co., Philadelphia, died recently at his home in Paoli, Pa., aged 70 years. He had retired from the firm in 1908.

Frederick F. Fitzpatrick, president, American Locomotive Co., New York, died in that city on Nov. 16.

Harris Whittemore, chairman of the board, Eastern Malleable Iron Co., Naugatuck, Conn., died suddenly at his home at Naugatuck, Nov. 29, of heart disease. He was born 63 years ago at Naugatuck, and in 1885, following his graduation from Phillips Andover academy started in the iron business as an office boy with the Cleveland Malleable Iron Co. Three years later he entered the sales department of the Naugatuck Malleable Iron Works. He advanced steadily and became president of this latter company, and on its consolidation with the Eastern Malleable Iron Co. he became president of the combined organization, which included several companies other than those mentioned.

Mr. Whittemore also had been a director of the New York, New Haven and Hartford railroad, Landers, Frary & Clark, New Britain, Conn., the National Malleable Castings Co., Cleveland, the Link-Belt Co., Chicago and the American Pin Co., Hartford, Conn.

Faked Foundry Facts

A Flat Parting

Book Review

The Metallurgists Manual, by T. G. Bamford and Harold Harris, cloth, 5½ x 8¾ inches, published by D. Van Nostrand Co. Inc., New York, and supplied by THE FOUNDRY, Cleveland, for $5, and in London, 416-17 Caxton House, Westminster, for 25s.

This book contains methods for carrying out most analyses or assays commonly met with in mining and metallurgy. It also explains how to conduct complete examinations of fuels and refractories, how to calculate furnace charges and contains essential information on the metallography, properties and uses of the industrial alloys. The book is divided into seven sections, the first of which is devoted to assaying. Part II covers analyses of various alloys including cast iron and steel. Fuels and refractories are covered in Part III, and smelting in Part V. Metallography and a summary of the manufacture of nonferrous castings are described in Parts VI and VII respectively. The authors have included a number of tables containing useful information in the back section of the book. Numerous tables, illustrations and diagrams are included in the text. An index carefully arranged assists the reader in locating the desired section.

Foundry Association Directory

American Foundrymen's Association

President, S. W. UTLEY, Detroit Steel Casting Co., Detroit; secretary-treasurer, C. E. HOYT, 140 South Dearborn street, Chicago; technical secretary, R. E. KENNEDY, 909 W. California street, Urbana, Ill.

The Buffalo Foundrymen
Buffalo

President, J. MCARTHUR, Washington Iron Works; secretary, W. J. WARK, E. J. Woodison Co., 146 Chandler street. Meetings on third Wednesday of the month at 146 Chandler street.

Chicago Foundrymen's Club
Chicago

President, G. H. ROLLINSON, American Brake Shoe & Foundry Co.; secretary, ALBERT N. WALLIN, S. Obermayer Co., 2563 W. Eighteenth street. Meetings second Saturday in each month at the City club, 315 Plymouth court.

Connecticut Foundrymen's Association

President, FRED W. STICKLE, Capitol Foundry Co., Hartford, Conn.; secretary, C. S. NEUMANN, Union Mfg. Co., New Britain, Conn. Meetings are on second Friday of each month in various parts of the state.

Detroit Foundrymen's Association
Detroit

President, J. J. BOLAND, Griffin Wheel Co., Detroit; secretary, ROBERT HOPE, Holley Carburetor Co., Detroit. Meetings third Thursday in each month at the Union League club, 35 Grand River avenue, Detroit.

East Bay Foundrymen's Association
Oakland, Calif.

Secretary, H. L. MARTIN, Marchant's Foundry Co., 4401 East Tenth street, Oakland, Calif.

Metropolitan Brass Founders' Association
New York

President, WILLIAM EMBER, Jefferson Brass Foundry, 62 Delevan street, Brooklyn, N. Y.; secretary WILLIAM E. PAULSON, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meeting second Wednesday in each month at the Building Trades club, 34 West Thirty-third street, New York.

Newark Foundrymen's Association
Newark, N. J.

President, J. L. CARTER, Barlow Foundry Inc., Newark; secretary, W. H. MANTZ, Atlas Foundry Co., Irvington, N. J. Meeting called by president.

New England Foundrymen's Association

President, HENRY S. CHAFFEE, Builders Iron Foundry, Providence, R. I.; secretary, FRED F. STOCKWELL, 205 Broadway, Cambridgeport, Mass. Meetings second Wednesday of each month at the Exchange club, Boston. Outings usually are held in the summer months.

Ohio State Foundrymen's Association

President, C. C. SMITH, Toledo Steel Casting Co., Bancroft and Smoad avenue, Toledo, O.; secretary-manager, ARTHUR J. TUSCANY, 5713 Euclid avenue, Cleveland.

Philadelphia Foundrymen's Association
Philadelphia

President, WALTER WOOD, R. D. Wood & Co., Philadelphia; secretary HOWARD EVANS, Union League club, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Southern Metal Trades Association
Atlanta, Ga.

President, GEORGE B. COCKER, Gastonia, N. C.; secretary, W. E. DUNN JR., Healy building, Atlanta, Ga.

Pittsburgh Foundrymen's Association
Pittsburgh

President, C. D. CAREY, American Steel Foundries, Pittsburgh; secretary-treasurer, WILLIAM J. BRANT, Wm. J. Brant, Bessemer building, Pittsburgh. Meeting on the third Monday of the month, except in July and August, at Fort Pitt hotel.

Quad-City Foundrymen's Association
Davenport, Iowa

President, HYMAN BORNSTEIN, Deere & Co., Moline, Ill.; secretary-treasurer, H. A. DEANE, Deere & Co., Moline, Ill. Meetings the third Monday of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

Tri-City Technical Council
Moline, Ill.

Chairman F. V. SKELLEY, Tri-City Railway Co., Rock Island, Ill.; treasurer, MAX SKLOVSKY, Deere & Co., Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association
Cincinnati

President, HAROLD P. RITTER, John A. Oberhelman Foundry Co., 3323 Colerain avenue; secretary, GEORGE W. PIEHL, Wessling Bros. Foundry Co., 1607 McLean avenue. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association
Minneapolis-St. Paul

President, H. H. NOTT, Smith System Heating Co., Minneapolis; secretary-treasurer, C. E. LANGDON, 3849 Lyndale avenue, south, Minneapolis. Meetings monthly at the Athletic club.

Washington Foundrymen's Club
Seattle

President, RONALD KUCHER, Olympic Foundry Co., Argo Station, Seattle; secretary, EDWARD C. GUSTIN, The Prescott Co., 1 West Lander street, Seattle. Meetings second and fourth Tuesdays of each month at the Elks' Temple, Fourth avenue and Spring street.

Is Director of Sales

Andrew H. McDougall recently became vice president and director of sales of the Whiting Corp., Harvey, Ill., succeeding the late N. S. Lawrence. Mr. McDougall has been with the firm since 1903. Prior to his graduation from the University of Michigan, Ann Arbor, Mich., in 1901 he was machinist with E. D. Smith Co. and the Allis-Chalmers Mfg. Co., Milwaukee. Between 1901 and 1903 Mr. McDougall was a special wood and iron working machinery designer for the Studebaker Bros. Mfg. Co., South Bend, Ind.

ANDREW H. McDOUGALL

Officers Are Elected

Recently the board of directors of the Fulton Foundry & Machine Co., Cleveland, held a meeting and elected the following officers: A. E. Gibson, president and treasurer; G. W. Burrell, vice president and Fred Watson, secretary. The board of directors consists of the officers and Clifford Pierce and Lloyd Brown. The firm operates a gray iron foundry specializing in heavy castings and acid resistant castings for the chemical industry.

Meet in Cleveland

The Ohio section of the American Institute of Mining and Metallurgical Engineers held a dinner meeting at the Allerton hotel, Cleveland, on Dec. 2. After the dinner officers for the ensuing year were elected as follows: Col. F. B. Richards, M. A. Hanna Co., Cleveland, chairman and T. H. M. Crampton, Carey Co., Cleveland, secretary-treasurer. Col. Richards and Mr. Crampton succeed Prof. H. M. Boylston and C. E. Murray, who has been secretary of the group since 1920. Addresses were given by E. DeGolyer, national president, and Dr. H. Foster Bain, national secretary of the institute. Mr. DeGolyer spoke on geophysical methods for oil prospecting and Dr. Bain talked on political conditions affecting mineral production in the Far East.

Detroit Foundrymen Meet

The third regular meeting of the Detroit Foundrymen's association was held Nov. 18 at the Masonic temple. In the absence of J. J. Boland, president, Robert Scott, vice president, presided. Prof. Campbell, University of Michigan spoke on some foundry problems which his department is working on and Prof. Boston also from the university explained work done on the problem of relation of hardness to machinability of castings. Prof. White talked on his recent trip through Europe. The next meeting of the association will be held Dec. 15 and the speakers will be J. D. Stoddard, Detroit Testing Laboratory; F. B. Stevens, F. B. Stevens Co., and E. J. Woodison, E. J. Woodison Co.

Lists Bearing Uses

An exceedingly interesting and well illustrated booklet describing various uses of roller bearings recently has been published by the Hyatt Roller Bearing Co., Newark, N. J. The first section of the publication is devoted to the application of roller bearings to journal boxes used by steam and electric railroads. Other uses mentioned include equipment in steel mills, power transmission machinery, industrial trucks and trailers, reduction gears, machine tools, conveyors and electric motors.

Forms New Association

Ralph R. Silver, for the past 12 years advertising manager, American Cast Iron Pipe Co., Birmingham, Ala., now is associated with the Cox Advertising agency in the same city. Under plans of reorganization Mr. Silver will acquire a substantial interest in the firm. Besides being advertising manager of the pipe company, he also was assistant secretary and a member of the board of directors. Mr. Silver is known widely in the foundry and waterworks industries.

RALPH R. SILVER

Ludlum Steel Co., Watervliet, N. Y., has published a 24-page booklet describing its method of heat treating steels with the nitrogen process. The booklet also contains a number of tables and diagrams giving the physical properties of the treated steel.

Foundry Equipment Orders Gain

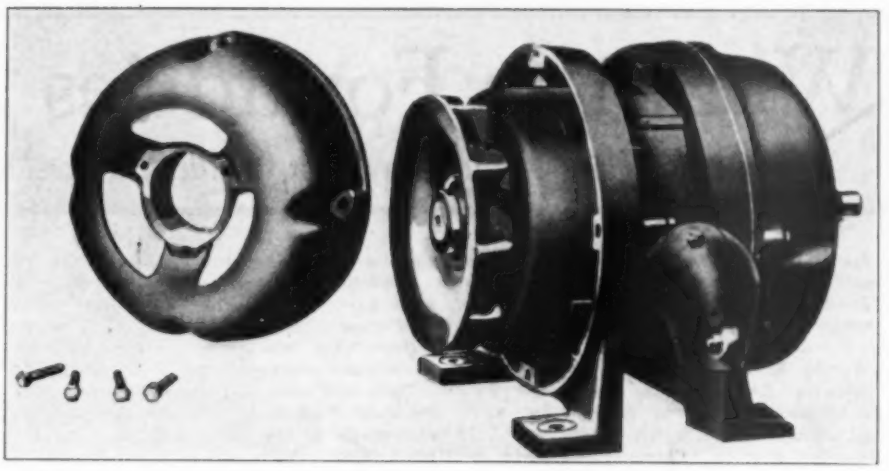
THE index of gross orders for foundry equipment in October was 98.0, *as compared with* 80.4 *in September, according to a recent report of the Foundry Equipment Manufacturers association. The index of shipments in October was* 113.4 *and the index of unfilled orders* 106.3. *The index figure represents the business done expressed as a percentage of an arbitrary base, which is the average monthly shipments for* 1922-23-24. *The index of gross orders since January,* 1921, *is as follows:*

	1921	1922	1923	1924	1925	1926	1927
January	30.9	44.5	157.3	141.8	104.2	168.2	180.4
February	34.5	37.0	143.6	121.0	108.8	154.9	198.0
March	39.3	94.0	160.8	121.9	159.3	157.3	131.1
April	31.0	93.0	151.9	146.8	124.3	113.2	130.0
May	41.9	124.4	174.6	108.4	113.3	128.5	134.8
June	25.7	131.5	141.8	96.4	110.5	133.5	138.4
July	50.5	87.6	118.4	62.8	117.0	127.3	89.9
August	22.7	114.1	119.0	77.5	190.0	141.2	106.4
September	38.7	72.8	78.0	66.0	94.2	114.0	80.4
October	42.5	107.3	115.1	85.5	149.5	140.5	98.0
November	37.1	98.8	91.5	91.0	180.3	133.4	.....
December	33.4	112.0	138.4	137.8	140.1	181.0	.....

Fans Cool Motor

The Reliance Electric & Engineering Co., Ivanhoe Road, Cleveland, has developed a new, fully enclosed, fan-cooled induction motor. Internal fans are used to circulate the air around the coil heads where a large portion of the heat is generated. This causes the internal heat to be transmitted to radiating bonnets which entirely surround the coil heads and seal the motor against the entrance of dirt. A strong blast of air is blown across the outside surface of the radiating bonnets. This blast of air absorbs the heat from the bonnets and carries it away from the motor into the surrounding atmosphere. The current of air also passes across the outside of the stator core.

The outside blast of air is produced by large radial fans, one on each end of the motor shaft just outside of the bonnet. The external fans are surrounded and protected by a standard bearing bracket such as is used in the ordinary induction motor. The additional parts required for the secondary ventilation are inside of the motor. The external appearance and the mounting and limiting dimensions are the same as the standard induction motor with the same size frame.



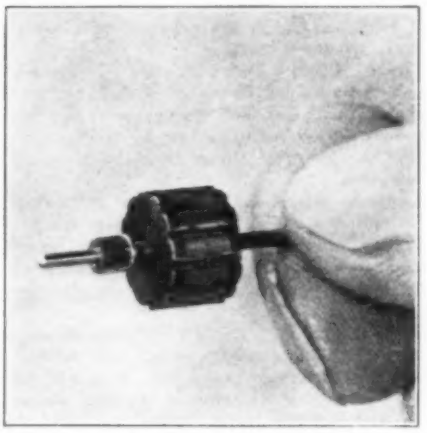
INTERNAL FANS ARE USED TO CIRCULATE THE AIR AROUND THE COIL HEADS

Builds Portable Conveyor

The Jeffrey Mfg. Co., Columbus, O., has introduced a new portable scraper conveyor for handling coal and coke. The principle differences between the new conveyor and previous models are the reduced weight of the frame, the increased size and strength of the conveying chain and the larger screening chute. The new 25-foot conveyor is 1100 pounds lighter than its predecessors.

Although the frame is lighter, the working and wearing parts of the machine actually are stronger. In the conveying chain, the flights are ¼-inch steel plates and L shaped, and run the full width of the trough. The bottom plates of the loading end of the trough also are ¼-inch steel. These plates have been made extra heavy to stand the pounding of the material in the loading pit. The wheels are 4 feet in diameter, on 3-inch tires, swiveled to turn in either direction. The wheels are bronze bushed and pressure greased. Power for the conveyor is supplied by an electric motor running on either ball or roller bearings as desired.

To raise or lower the discharge end of the conveyor, an easily handled worm-geared winch pulls a cable over the top of a short, rigid mast. This winch is high pressure lubricated, as is every other transmission part.



ROTOR OF A SMALL ELECTRIC MOTOR

AN ESPECIALLY LIGHT FRAME IS USED ON THE PORTABLE CONVEYOR

Builds Small Motor

A motor so small its rotor could be wrapped in a postage stamp is used by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., for timing a watthour meter demand register. It is the smallest synchronous motor ever manufactured for practical use. Four million of these complete motors, together with their reduction gears, would be required to balance a large 8000 horsepower motor recently built in the Westinghouse shops. The diameters of their shafts are in the ratio of 512 to 1. The rotors are still smaller in proportion as 37 million are required to equal the weight of the large one. A view of the rotor of the small motor is shown in the accompanying illustration.

Remove to New Location

Scully Jones & Co., dealer in new and used foundry equipment and manufacturers of production tools, formerly located at 2012 West 13th street, Chicago, has removed to its new plant at 1901-12 South Rockwell street, Chicago.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Board of education, Cleveland, F. G. Hogan, director, contemplates building a foundry addition at 535 Eagle avenue.

National Casting & Pattern Corp., Brooklyn, N. Y., has been incorporated with $15,000 capital by E. C. Morsch, 1028 Gates avenue.

Columbia Radiator Co., McKeesport, Pa., has awarded the general contract for a 1-story addition 70 x 212 feet, to its plant.

Hills-McCanna Co., Chicago, has moved into its new plant at 2439-59 Nelson street. (Noted Aug. 15)

Excelsior Stove & Mfg. Co., Quincy, Ill., is building a new foundry, 120 x 400 feet, and a 6-story warehouse 70 x 180 feet. (Noted Nov. 10)

General Bronze Corp., New York, has been incorporated with $3,000,000 preferred and 300,000 shares no par value stock by U. S. Corp., 150 Broadway, attorney.

Oregon City Foundry Co., Oregon City, Oreg., will rebuild its plant damaged recently by fire, and has also purchased a building to house the machine and pattern shop.

Southwestern Cast Iron Pipe Co., L. L. Featherstone, 516 Dalzell street, Shreveport, La., plans to build a plant including a foundry and machine shop.

Federal Brass Mfg. Co., Marysville, O., operating a brass and aluminum foundry, machine shop, etc., is building an addition to its plant to take care of increased business.

Frink Co. Inc. has consolidated with the Sterling Bronze Co., both of New York, under the name of the Frink Corp., to manufacture lighting fixtures, ornamental designs, etc.

Lycoming Mfg. Corp., Williamsport, Pa., makers of automobile gasoline motors, is expanding its plant to provide facilities for a production of about 2000 engines a week.

Service Bronze & Brass Works, Portland, Oreg., has been incorporated by Earl Henderson, Peter DePauw and G. H. Lester. The new firm will have a capital stock of $40,000.

Progress Stove & Range Co., Louisville, Ky., W. L. Hollis, president, reports that it will rebuild its foundry which recently suffered a $20,000 loss by fire.

John Polachek Bronze & Iron Co., and the Renaissance Bronze & Iron Works, both at Long Island City, N. Y., have been merged as the General Bronze Corp.

Lehigh Foundries Inc., Easton, Pa., has been incorporated with $100,000 capital to engage in general foundry and machine shop business by Alexander A. Shumann, Morrisville, Pa. (Noted Dec. 1)

Riedel & Sons Mfg. Co., New Brighton Pa., manufacturer of castings of bronze, etc., is building an addition to its plant to engage in steel castings business. The building will be 40 x 60 feet.

Behnke & Jensen, Royalton, Wis., has work completed on a new aluminum foundry, built as an extension to its own machine shop business. The company manufactures vacuum pumps and tanks, pulsators, etc.

Hudson Mfg. Co., 324 Third avenue North, Minneapolis, has awarded the general contract for its new plant in Hudson, Wis., to **Edward Bjorklund, 914** Builders Exchange, St. Paul. (Noted July 1)

A. Weiskittel & Sons Co., Lombard and Twelfth streets, Baltimore, will build a 1-story addition to its plant for the manufacture of stoves, furnaces, etc. The company operates a brass foundry, grinding rooms, etc.

Caterpillar Tractor Co., Peoria, Ill., will build a new factory unit 400 x 1200 feet to cost about $500,000. Machinery for the new building, for which the contract has been let will cost another $500,000. (Noted Dec. 1)

Plant and equipment of the bankrupt Canton Steel Foundry Co., Canton, O., were sold at auction to the Luntz Iron & Steel Co., for $120,000. The sale has been confirmed by the federal court.

F. G. Volpe, Hager street, Arlington, Mass., is inquiring for machinery and equipment for a proposed foundry and machine shop to be built at 14 Kent street, Somerville, Mass. (Noted Dec. 1)

Hugo B. Behrm Co., Boston, has been incorporated with $10,000 capital to manufacture woodworking machinery, and patterns in wood and metal by Joseph E. Magnuson, 128 Willis avenue, Medford, Mass.

Jacobs & Co. Inc., 631 South Delaware street, Indianapolis, maker of metal and wood patterns, has awarded the general contract for two 1-story additions, 60 x 90 feet and 25 x 60 feet, to Mount Bros., 812 South Roens street.

Southern Manganese Steel Co., St. Louis, is installing a new 500-pound electric furnace for the production of small, light manganese steel castings. This will operate as an auxiliary to the firm's 1½-ton electric furnace.

Axelson Machine Co., Los Angeles, is constructing buildings and installing new machinery in an extensive expansion program for the manufacture of oil-well pumps, sucker rods and machine shop lathes for the oil industry.

Sheffield Steel Co., Railway Exchange building, Oklahoma City, Okla., is inquiring for foundry and machine shop tools including riveting, boring and punching machines, welding equipment and cranes, for its machine shop being built here.

Reliance Mfg. Co., Pasadena, Calif., recently completed its new plant. The foundry building is 115 x 180 feet with a clear height of 20 feet. The machine shop is 60 x 200 feet with adjoining lean-to extensions. W. L. Thompson is president of the firm. (Noted Sept. 15)

Austin Arcola plant of the American Radiator Co., Buffalo, will be removed to Gloucester, N. J., according to a report by Charles Hessler, general manager of the plant. The new plant will be on the site of the former Pusey & Jones shipyard on the Delaware river.

Gaffers & Sattler, Montibello, Calif., has awarded a contract to William P. Neil Inc., for a foundry and machine shop addition containing 15,000 square feet of space. The building will be 100 x 153 feet and with equipment will represent an investment of $50,000. (Noted Dec. 1)

Heebner & Sons Inc., Lansdale, Pa., operator of gray iron, brass and aluminum foundries and manufacturer of farm machinery has been reorganized. The plants shut down since April, 1926, have been placed in operation again. Harvey V. Mitchell is president and Ira B. Haar, secretary and treasurer of the new company.

Rogers Foundry & Mfg. Co. and the United Iron Works, both at Joplin, Mo., are to be consolidated according to a report from C. B. Rogers, president of the former firm. The name of the new corporation will be the Rogers Iron Works Co., with 10,000 shares of capital stock and will be capitalized at $1,000,000. C. B. Rogers will be president and R. H. Linn, secretary.

A one-third interest in the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., has been purchased by Eastman Dillon & Co., Chicago investment brokers. Authority is being sought to change the firm's capitalization from 23,258 outstanding shares of $100 each to 210,000 shares no-par value. The price paid by the investment brokers is stated to be $1,400,000.

Malleable Iron Fittings Co., Branford, Conn., has purchased the Clark-Williams Engineering Co., Bridgeport, Conn. The latter firm manufactures a pole foundation consisting of two heavy malleable iron castings which clamp the butt of the pole to a concrete base. Rolland Williams, of the Clark-Williams company has joined the staff of the Malleable company and offices have been consolidated at Branford.

Newton Die Casting Corp., which recently was organized as a merger of the die casting division of the National Lead Co., and the Marf Machine & Die Casting Co., has been incorporated under the laws of Connecticut with $800,000 capital. Plants of the firm are located at Brooklyn, N. Y. The firm also has acquired a large 6-story reinforced concrete building at New Haven, Conn., where it ultimately will concentrate its production facilities. W. G. Newton, South Orange, N. J., is president and general manager of the company.

New Trade Publications

RAILROAD EQUIPMENT—Worthington Pump & Machinery Corp., New York, has issued a catalog describing its equipment for railroads. This includes feed-water heaters, air compressors, steam and power driven reciprocating pumps, etc.

COMBUSTION METERS—Leeds & Northrup Co., Philadelphia, has published a reprint of an article describing the use of meters for maintaining good combustion control.

MAGNETIC BRAKES—Cutler-Hammer Mfg. Co., Milwaukee, recently has issued a 20-page catalog showing the features of its magnetic brakes. Applications of the brake are discussed and ratings, dimensions and other data are given. The brakes are made in two types for direct and alternating current service.

WOODWORKING MACHINES—Oliver Machinery Co., Grand Rapids, Mich., has issued a 32-page catalog describing its saw benches, band saws, jointers, trimmers, grinders, sanders, and other types of woodworking machinery. Illustrations of the various machines are presented with features of construction and dimensions.

ELECTRIC FURNACES—Greene Electric Furnace Co., Seattle, has published a folder giving the sizes and capacities of its electric arc furnace.

Let common sense convince you!

Here is a scrap pile. No one can know without expensive analysis of each piece what it contains.

Scrap is of such uncertain composition that its use results in castings varying widely in mixture, hence in physical properties. Then, too, ten chances to one scrap will contain aluminum, iron or other impurities resulting in the production of imperfect or worthless castings.

Here is an Ajax Process Ingot—The Ajax Process takes virgin or refined metals and turns them into a homogeneous ingot exact as to formula and results.

Since 1880, Ajax Process Ingots have been producing Perfect Castings and saving the foundryman time, fuel and metal. Castings made from Ajax Process Ingot machine easier too, because there are no hard spots to spoil tools.

Let common sense convince you of the worth of Ajax Process Ingots.

AJAX PROCESS INGOTS

Ajax-Wyatt Furnaces Cut melting costs ¼ to ¾c per lb.

Where the Ajax-Wyatt Electric Furnace has been installed melting costs have been cut immediately ¼ to ¾ cents per pound, depending on the condition encountered and the nature of the stock melted.

The saving effected in melting 5000 pounds of brass per day will pay for an Ajax-Wyatt furnace in less than one year.

The chief reasons for this important saving are:

Lower fuel costs—lower crucible costs—lower labor costs—lower metal loss—improved working conditions—accurate temperature control—elimination of lost heats and defective castings.

May we send full details?

AJAX WYATT

ELECTRIC FURNACES

The Ajax Metal Company

Established 1880

PHILADELPHIA

Use One

One drum will show yo
ness of this splendi
you that Linoil wil
doing for hundreds
will show that a
yours by stan

The Werner G.S

Cleveland-21

BOSTON—200 Devonshire St.
BUFFALO, N. Y.—81 Linden Ave.
CHICAGO—327 So. La Salle St.
DAYTON—125 Elmwood Ave.
DETROIT—17314 Parkside Ave.
Cable Address "Wersmithco".

eDrum

ow you the worthwhile-
dic oil. It will prove to
vil do for you what it is
ed of other foundries. It
t a positive saving will be
nd ardizing on the logical oil.

G. Smith Company

d–2191 W. 110th St.

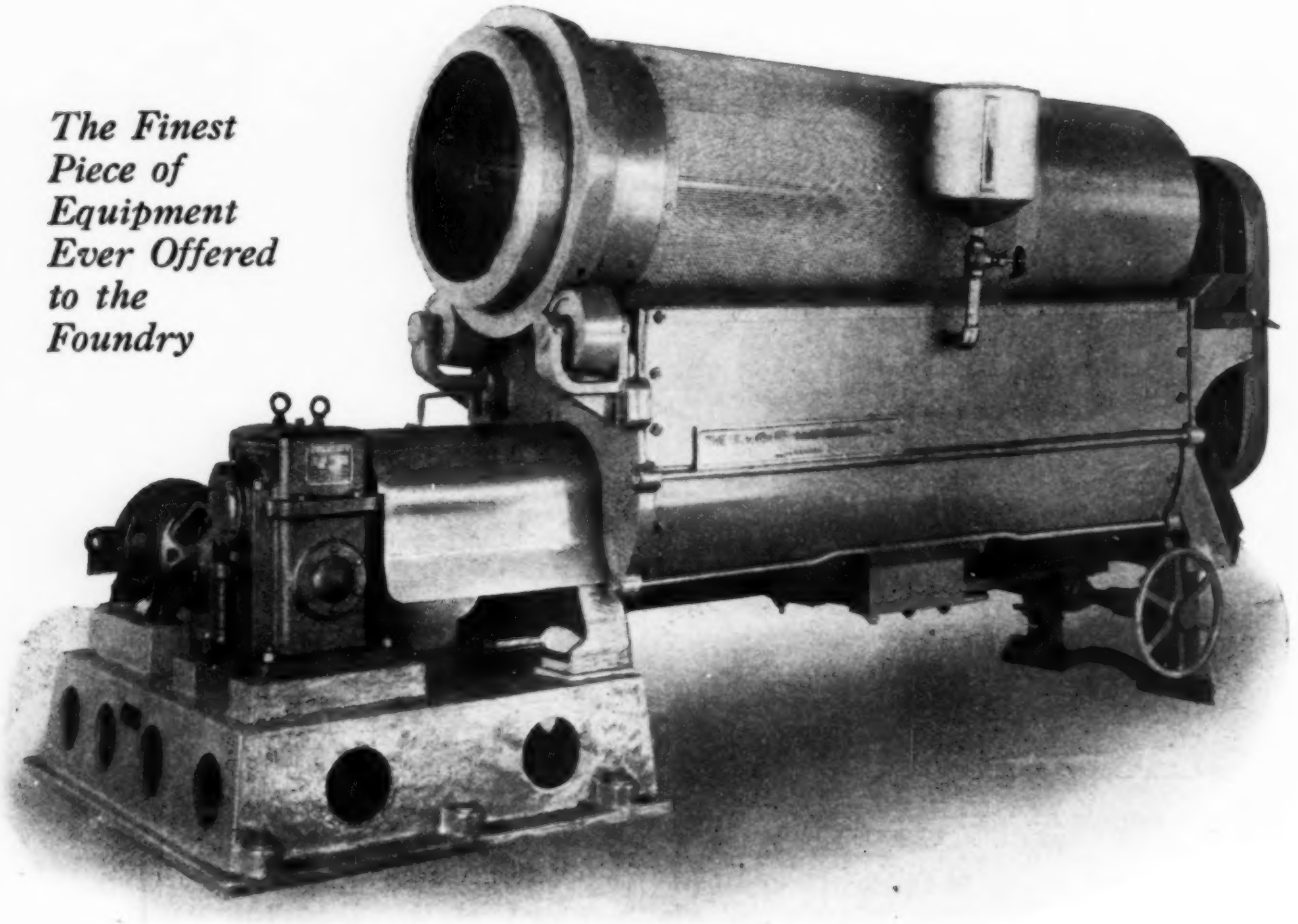
INDIANAPOLIS—18 South New Jersey St.
LOS ANGELES—2550 East 9th St.
Private Wires Western Union "WA" Postal 18

PHILADELPHIA—704 Com'l Bldg.
SAN FRANCISCO—537 Second St.

The Standard

A New High Speed Production

The Finest Piece of Equipment Ever Offered to the Foundry



Front View No. 3 B-Core and Facing Sand Mixer

FOR twenty-seven years "STANDARD" Sand Handling Machinery has been building an enviable record for itself wherever sand machinery is used—a record for performance, for endurance, for lower maintenance cost!

And all the experience, all the knowledge, all the ability of our staff as a result of those years, have gone into the development and production of a Sand Mixing Machine which will banish forever those troubles "you used to have".

We have produced such a machine—

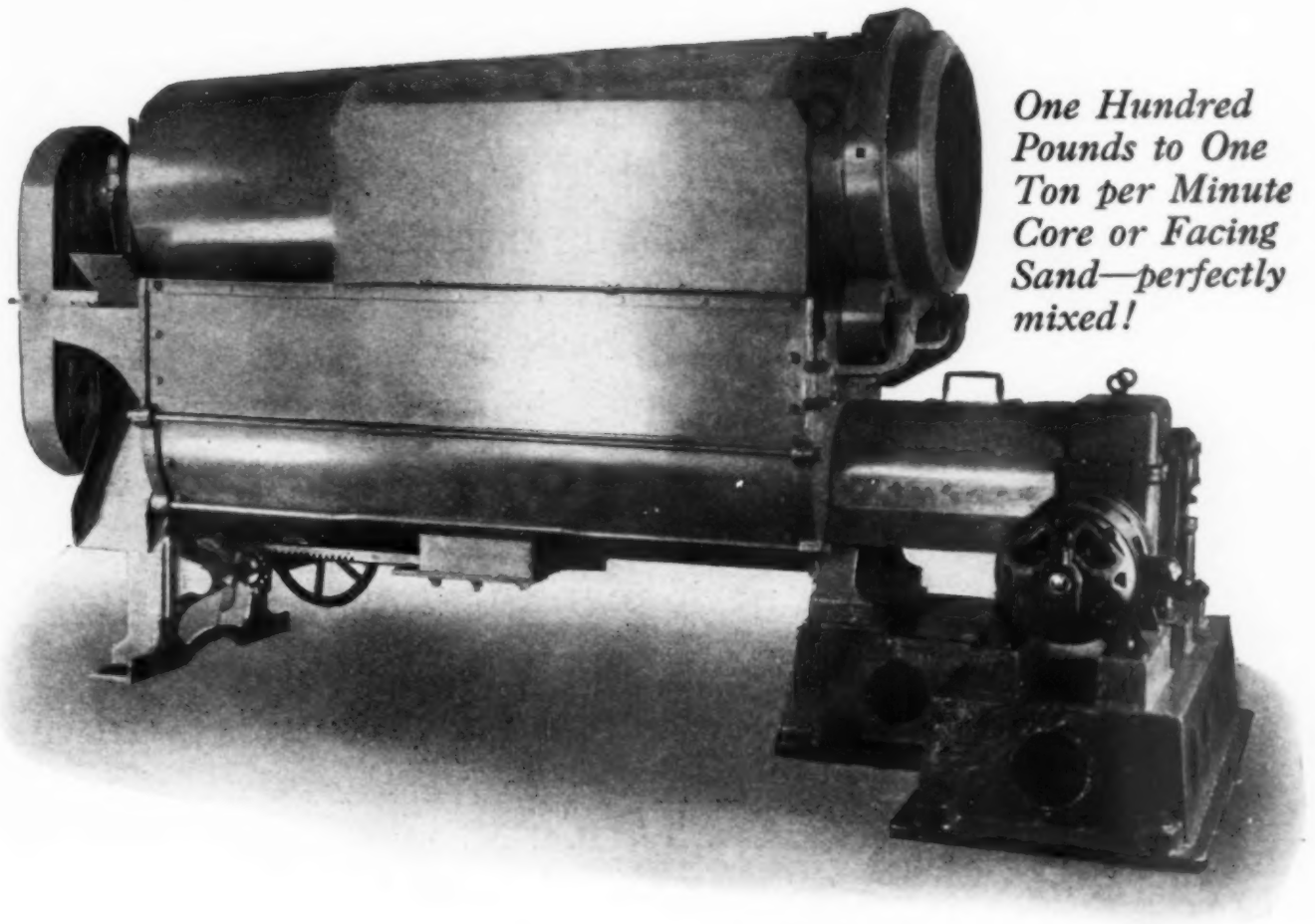
We offer it to you in three sizes, capacity 3 to 60 tons per hour, perfectly mixed.

The Standard Sand &

5151 St. Clair Ave., N.E.

Master Mixer

Core and Facing Sand Mixer



One Hundred Pounds to One Ton per Minute Core or Facing Sand—perfectly mixed!

Rear View No. 3 B-Core and Facing Sand Mixer

A product of 27 years experience

We have gone the limit. It can't be built better

A machine, we or you don't have to make excuses for

All parts are machined to alignment and fit

All parts have a large factor of safety

The quality of all material is that which is best suited for long wear and the hard service a foundry machine receives

For example, Timken roller bearings are used throughout

Motor drive thru a Horsburg & Scott Timken Bearing Speed Reducer

Not a gear exposed to sand and dust

Noiseless operation

Paddle and liner material 600 Brinell

Rack and pinion operated discharge gate

Screens, tempers and mixes in one operation

Furnished with feed hopper to increase capacity

The best built sand mixing machine you can buy

We are ready to prove by competitive test that it will mix more thoroly in less time and run much longer without a dime for repairs, than any other machine

Way down upkeep and quality of product are the real outstanding features of this new standard core and facing sand mixer

Three sizes—10 cu. ft., 15 cu. ft. and 27 cu. ft. per batch

The same machine built to operate continuously will deliver from one to sixty-five tons per hour

d& Machine Company

CLEVELAND, OHIO

UNIFORMITY . . . .
Prevents Waste

Waste of anything you use is serious. Waste of finished castings is doubly so. A rejected casting means not only wasted material but also lost time and wages.

Standardizing on the use of a core oil of known quality is a means for reducing both kinds of waste. The permanent formulas of Kellogg Core Oils are established to prevent the need for guess work in making good cores.

Core Oil Department

Spencer Kellogg and Sons, Inc.

Buffalo, N. Y.

Minneapolis	Cleveland	Kansas City
Cincinnati	Buffalo	Philadelphia
Detroit	Los Angeles	St. Louis
Chicago	Boston	Grand Rapids
Columbus, O.	New York City	Milwaukee
San Francisco	Springfield, O.	Seattle

KELLOGG'S

KELLOGG'S *CORE OIL* BRANDS

Kelloil
Gold Bond XX
Cylinder Special
Gold Bond
Radiation Special
No. 10
Skasco

All these are linseed base core oils. We are the only manufacturers of core oils who make linseed oil.

CORE OILS

A Thousand Industries prove this every day

A Carload of Sand

That must be
Freighted, Handled and Stored

Makes A Carload of Dust

to be
Ventilated
Arrested
and Disposed Of

A Ton of "Certified" Steel Abrasives

In 20 Small Bags, easily handled, laid alongside the Sand-Blast, with freight only on a ton.

Outlasts A Carload of Sand

Gives Better Working Conditions With Ventilation and Disposal of only the dust that comes from your castings.

What happens to your Abrasive, after it is "blown" tells the "Cost per ton" of Sand-Blasting

ANGULAR STEEL GRIT Manufactured only by **SAMSON STEEL SHOT**

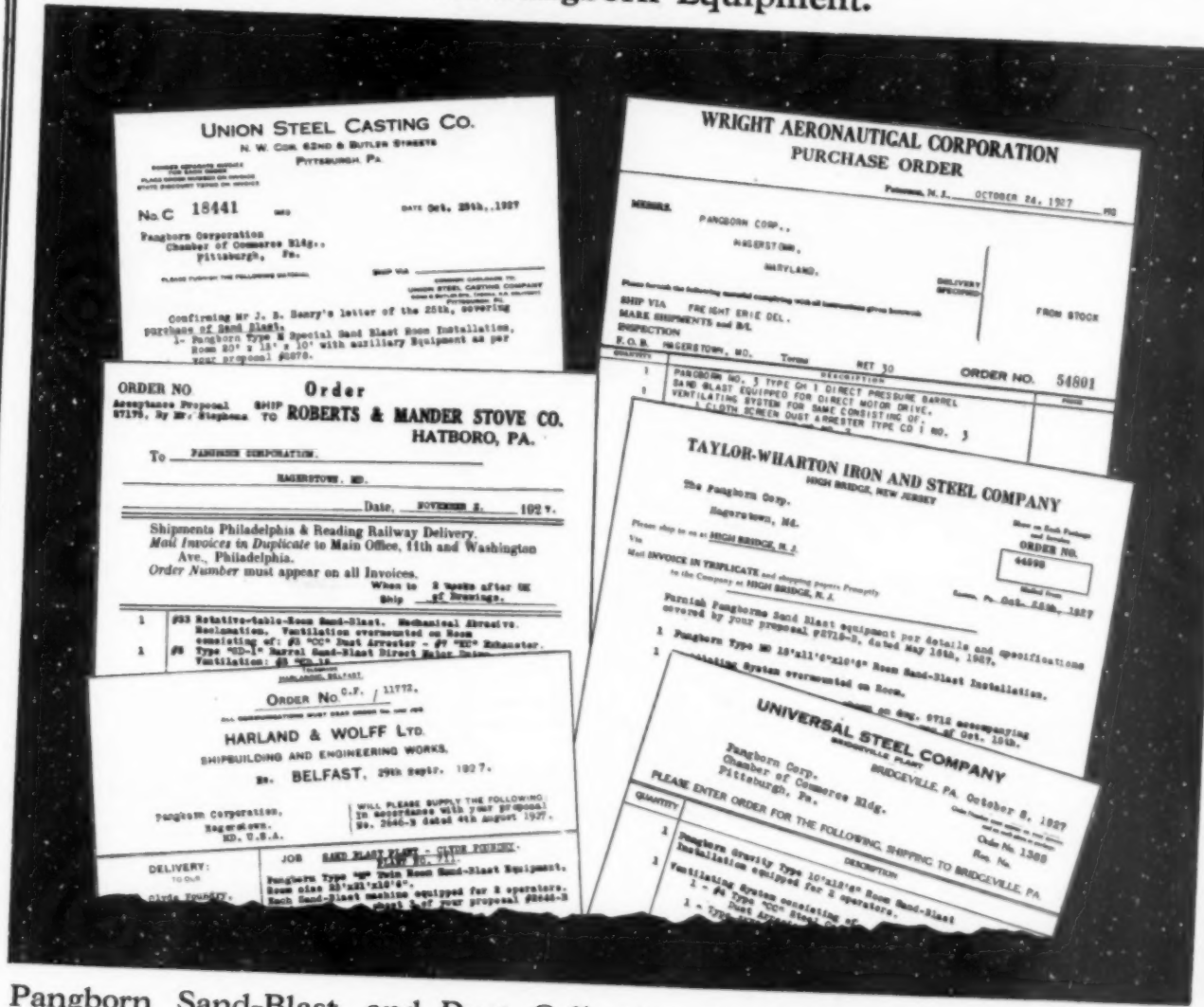
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Steel Shot & Grit Co., Amesbury, Mass.

Certified Steel Abrasive is recommended by the leading Sand-Blast Manufacturers

It is Pangborn Results

that keep Pangborn shops busy when others are dull

A few orders within a short period, that tell the story better than we can and from both sides of the ocean. 60% of these orders are "repeat" business from satisfied users of Pangborn Equipment.


UNION STEEL CASTING CO.
N. W. COR. 62ND & BUTLER STREETS
PITTSBURGH, PA.
No. C 18441
Pangborn Corporation
Chamber of Commerce Bldg.,
Pittsburgh, Pa.
Confirming Mr J. B. Henry's letter of the 25th, covering purchase of Sand Blast:
1- Pangborn Type B Special Sand Blast Room Installation,
Room 20' x 12' x 10' with auxiliary Equipment as per your proposal #5878.
WRIGHT AERONAUTICAL CORPORATION
PURCHASE ORDER
Paterson, N. J. OCTOBER 24, 1927
PANGBORN CORP.,
HAGERSTOWN,
MARYLAND.
SHIP VIA FREIGHT ERIE DEL.
MARK SHIPMENTS and B/L
INSPECTION
F.O.B. HAGERSTOWN, MD. Terms NET 30
ORDER NO. 54801
1 PANGBORN NO. 5 TYPE CH 1 DIRECT PRESSURE BARREL SAND BLAST EQUIPPED FOR DIRECT MOTOR DRIVE,
1 VENTILATING SYSTEM FOR SAME CONSISTING OF:
1 CLOTH SCREEN DUST A FORESTER TYPE CO 1 NO. 3
ORDER NO
Acceptance Proposal 67195, By Mr. Stephens
SHIP TO ROBERTS & MANDER STOVE CO.
HATBORO, PA.
To PANGBORN CORPORATION.
HAGERSTOWN, MD.
Date, NOVEMBER 2, 1927.
Shipments Philadelphia & Reading Railway Delivery.
Mail Invoices in Duplicate to Main Office, 11th and Washington Ave., Philadelphia.
Order Number must appear on all Invoices.
Ship When to
1 #53 Rotative-Table-Room Sand-Blast. Mechanical Abrasive Reclamation. Ventilation overmounted on Room consisting of: #3 "CC" Dust Arrester - #7 "EC" Exhaustor.
1 #8 Type "SD-1" Barrel Sand-Blast Direct Motor Driven Ventilation: #3 "CC-12"
TAYLOR-WHARTON IRON AND STEEL COMPANY
HIGH BRIDGE, NEW JERSEY
The Pangborn Corp.
Hagerstown, Md.
Please ship to us at HIGH BRIDGE, N. J.
Via
Mail INVOICE IN TRIPLICATE and shipping papers Promptly to the Company at HIGH BRIDGE, N. J.
ORDER NO. 44898
Parish Pangborne Sand Blast equipment per details and specifications covered by your proposal #5715-B, dated May 26th, 1927.
1 Pangborn Type BC 15'x11'6"x10'6" Room Sand-Blast Installation,
1 Ventilating System overmounted on Room.
Drawing No. dwg. 5715 accompanying proposal of Oct. 10th.
ORDER No C.F. / 11772.
HARLAND & WOLFF LTD.
SHIPBUILDING AND ENGINEERING WORKS.
Bx. BELFAST, 29th Sept. 1927.
Pangborn Corporation, Hagerstown, MD. U.S.A.
WILL PLEASE SUPPLY THE FOLLOWING: In accordance with your pf proposal No. 5646-B dated 4th August 1927.
DELIVERY:
JOB SAND BLAST PLANT - CASTE FOUNDRY.
Pangborn Type BC Twin Room Sand-Blast Equipment.
Room size 31'x21'x10'6".
Each Sand-Blast machine equipped for 2 operators.
UNIVERSAL STEEL COMPANY
WASHINGTON PLANT
BRIDGEVILLE, PA. October 8, 1927
Pangborn Corp.
Chamber of Commerce Bldg.
Pittsburgh, Pa.
Order No. 1388
Req. No.
PLEASE ENTER ORDER FOR THE FOLLOWING, SHIPPING TO BRIDGEVILLE, PA.
QUANTITY
DESCRIPTION
1 Pangborn Gravity Type 10'x12'6"x8' Room Sand-Blast Installation equipped for 2 operators.
1 Ventilating System consisting of:
1 - #6 Type "CC" Steel Co.
1 - Type

Pangborn Sand-Blast and Dust Collection Equipment is the selection of Concerns who figure the "cost per ton of cleaning" as well as the purchase price.

Pangborn Corporation

Sand-Blast and Dust Suppression Equipment, Hagerstown, Md.

DISTRICT OFFICES

NEW YORK - - - - 30 Church Street
CHICAGO - - Railway Exchange Building
CLEVELAND - - - - Penton Building
DETROIT - - - General Motors Building
PITTSBURGH - Chamber of Commerce Bldg.

QUALITY **PC** PRODUCT

DISTRICT OFFICES

PHILADELPHIA - 1940 W. Ontario Street
ROCHESTER, N. Y. - 161 Scottsville Road
SPRINGFIELD, MASS. - 53 Glenwood Circle
ST. LOUIS - - - - - 1 Pitman Place

FIRST!

the world's two sponge iron plants are using DINGS *separators*

WHEN Thornhill & Anderson were developing their new sponge iron process at Hurley, New Mexico, their thorough investigation of the magnetic separators on the market resulted in the choice of Dings. Based on the performance of the two separators used in their experimental work Thornhill & Anderson specified an installation of 8 Dings Magnetic separators for the world's first sponge iron plant, a $1,600,000 project which they designed for the Tokiwa Co. at Kuji, Japan. The Dings Separators remove the iron as it is discharged from the furnace in a finely divided state from the waste material in the original ore and the excess coal. So well have these separators served that these engineers have already recommended the purchase of Dings for future extensions of the plant.

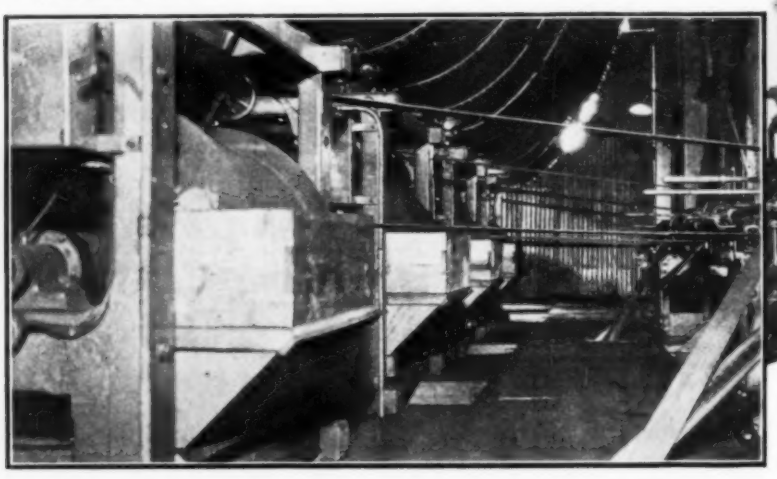
Dings superiority is further proved by the fact that the Hornsey-Wills process, an entirely separate and distinct process for the production of sponge iron, uses Dings Magnetic Separators. This process is to be used in the new plant of the National Tube Co., a subsidiary of the United States Steel Corporation, at Lorain, Ohio. Five Dings magnetic separators of the same type, but larger units than those in the Kuji project, have been installed.

In these two great pioneering projects, Dings is serving a vital need. Dings has helped to overcome the difficulties, has led the way to the better product and greater savings that come with sponge iron separation.

With the installation of Dings magnetic separators the Kuji plant produced tailings containing less than 1% of metallic iron and the concentrate contained 90 to 95% magnetic product.

DINGS MAGNETIC SEPARATOR CO.
675 Smith Street
Milwaukee, Wisconsin
Established in 1899

Dings *High Intensity* **MAGNETIC SEPARATION**



Sponge iron plant of the Tokiwa Co., at Kuji, Japan — Thornhill & Anderson engineers.

F12-15-Gray

Save 35% In Power And 24% In Blasting Hours Compared With Screened White Sand.

A CHICAGO manufacturer of porcelain-enameled sanitary ware had been using Illinois Screened White Sand at 70 to 75 lbs. pressure, through ¼ in. nozzles.

Our engineer conducted a series of tests, under his supervision, sandblasting two 47 lb. cast iron bowls at a time, in their Mott pressure room, with both abrasives at pressure ranging down from 75 lbs. to 40 lbs., through ¼ in. and ⅜ in. nozzles.

Flint Shot showed best results at 50 lbs. pressure through ⅜ in. nozzles—effecting a saving of 47% in blasting time and 50% in air power, compared with their previous practice.

At 50 lbs. through ⅜ in. nozzles with each of the two abrasives, Flint Shot showed a saving of 35% in air power and 24% in blasting time.

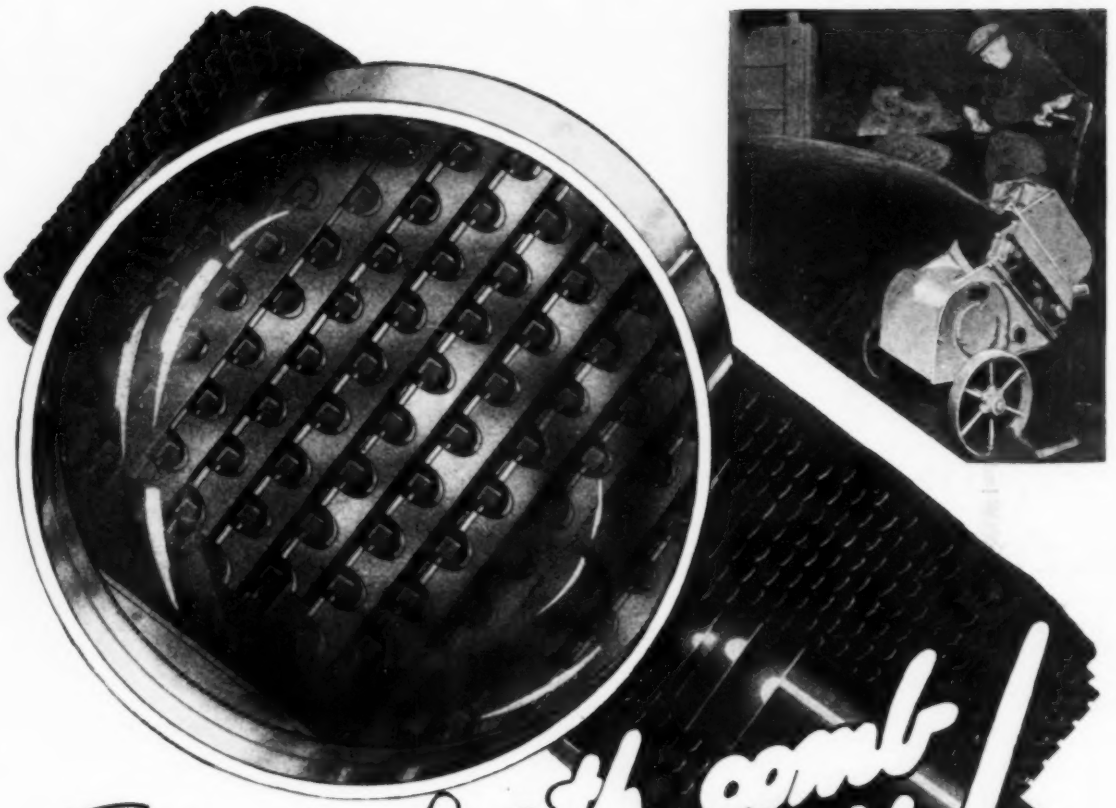
Air flow was controlled by a pressure regulator and recorded by a calibrated flow meter.

Cast Iron Bowls. Compare Old Practice With New

ABRASIVE	Orifice	Pressure	C. F. M. Free Air Abrasive Flowing	Actual H. P. 50% Comp. Eff.	Time Min. and Seconds	H. P. Hrs. Per Piece	Blasting Hrs. Per Piece
FLINT SHOT Present Practice	¼"	70-75	76.3	22.7	28'30"	5.23	0.237
" " Improved Practice	⅜"	50 lbs.	87.1	20.8	15'3"	2.61	0.126
	PER CENT SAVING					50%	47%
Comparing Abrasives Under Identical Conditions							
Ill. Scr. W. Sand Imp. Practice	⅜"	50 lbs.	93.6	22.3	21'30"	4.01	.179
Flint Shot " "	⅜"	50 lbs.	87.1	20.8	15'03"	2.61	.126
	PER CENT SAVING					35%	24%

ONCE AGAIN: *Screened White Sand is NOT "Flint Shot"*

UNITED STATES SILICA CO.
122 South Michigan Ave. Chicago



It's the tooth comb belt that does it!

The secret of the great success of the *ROYER Sand Separator and Blender* is the *belt*, of special composition of fabric and rubber, studded with steel sprigs, which are spaced to form pockets between the sprigs to carry the sand.

The blending of sand is accomplished in the hopper of the "ROYER". As the steel sprigs enter the hopper at the bottom they set up a combing action on the sand, the grains lodging in the pockets formed by the spacing of the sprigs. Due to the speed of travel of these sprigs the pockets are not completely loaded until they have traveled the entire length of hopper, and for this reason the pockets have collected portions of all the various ingredients in the hopper. The mixture is then unloaded by centrifugal force as the sprigs emerge underneath the sand sweep and pass around the upper pulley.

Because of the speed of travel and the spacing of the sprigs scrap, nails, pebbles, etc., do not lodge in the pockets but gravitate to the bottom of the hopper where they are discharged through a retainer when the belt is running free from sand.

Invest in a "ROYER" for better blended sand and increased dividends.

Royer Foundry & Machine Co. Kingston Station Wilkes-Barre, Pa.

Representatives

Hill & Griffiths Co., Birmingham, Alabama
Alexander Haigh, Boston, Massachusetts
Page & Ludwick, Chicago, Illinois
Pacific Graphite Works, Oakland, California
Fenton Foundry Supply Co., Dayton, Ohio
Snyder Foundry Supply Co., Los Angeles, California
David D. Baxter, Rochester, New York
Independent Foundry Supply Co., St. Louis, Missouri

Manufactured in Great Britain by Pneulec Ltd., Smethwick, near Birmingham
Manufactured in France by Fenwick Freres, 8 Rue de Rocroy, Paris

ROYER PRODUCTS RECOMMEND THEMSELVES

THE New American Sand Blast Room, after the most rigid and extended tests, has fulfilled our most confident expectations. It has definitely proved to be the most simple, most efficient, most economically operated and maintained sand blast room made.

The Gravity principle on which it is built and operated has long been acknowledged superior to the mechanical principle, in dependability and economy. It remained for the American Foundry Equipment Company, contributors of such worthwhile sand blast developments as the Humane Type Room and the down draft principle of ventilation, to bring the Gravity system to perfection.

The New American is a marvel of effective simplicity. There is practically nothing to get out of order. Costly and trouble-making mechanism is eliminated. Replacement and adjustment are reduced to a minimum. More efficient workmen, cleaner work, increased production, are secured.

The New American Sand Blast Room, in short, combines the highest efficiency with the lowest possible operating and maintenance cost.

THE AMERICAN FOUNDRY EQUIPMENT CO.
MISHAWAKA, INDIANA

Reproduced above is the Foreword from our book on the New *American* Sand Blast Room. This book is now in the mail. Extra copies will be furnished upon request.

Wishing you and your family
Health, Wealth and Happiness which
will insure you a Merry Christmas
and a Happy New Year

Sincerely yours,

National Engineering Company

NATIONAL ENGINEERING COMPANY

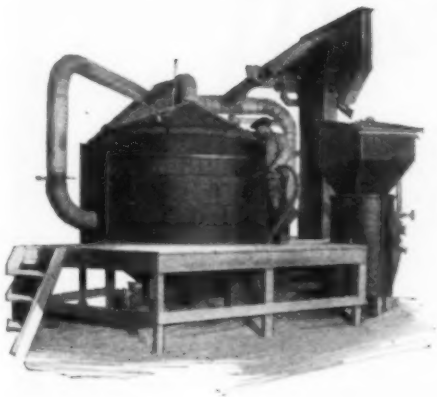
MACHINERY HALL BUILDING 549 W. WASHINGTON BLVD.

CHICAGO, ILL., U. S. A.

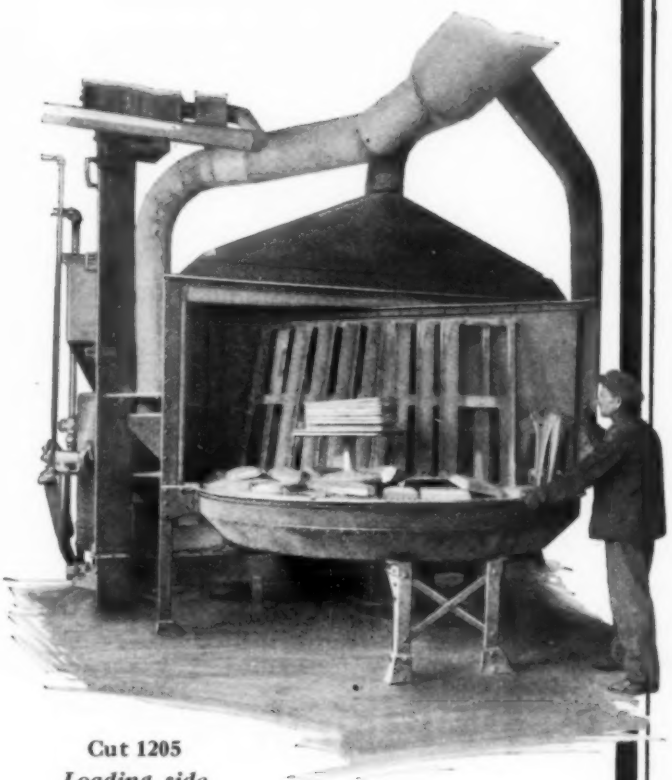
Designers and Builders of

Simpson Intensive Sand Mixers
Simpson Bucket Loaders
Sand Preparing, Handling and Conveying Machinery

Saving Money on a Complicated Cleaning Job!



Cut 1203
Type "AB" Slyblast Turntable Cabinet (Blasting Side)



Cut 1205
Loading side of Type "AB" Cabinet

Here is a case where a stove manufacturer had to clean a considerable tonnage of castings prior to enameling. They were fragile, of many sizes and shapes and tumbling was not practical. Each casting had to be sandblasted individually.

For a problem such as this, the *Turntable Cabinet* is precisely suited. It permits individual blasting, and a big daily tonnage can be economically cleaned.

The *operator stands outside* away from the dust. Excellent illumination inside permits him to clearly see the work being cleaned. Pieces to be *de*-enameled can be quickly cleaned with the other work.

Write for Bulletin S-255 describing three types of Turntable Cabinet.

Complete Line of
Cleaning Room Equipment
Sandblast Rooms—Rotary Tables,
Tilted Mills, Tanks
Tumbling Mills
Dust Arresters
Iron and Brass Cinder Mills
Sand Reclaiming Systems

THE W. W. SLY MANUFACTURING CO.

Branches in Principal Cities **4702 Train Ave., Cleveland, Ohio** *Established 1874*

SLYBLAST

for Sandblast · Shotblast · Gritblast

KORDEK

Reg. U. S. Pat. Off.

A Foundry Necessity that assures Quality and Economy

What It Is:

KORDEK is the highest grade dry vegetable core bond. Great binding strength, combined with utmost reliability makes it extremely economical. You will find it, always, absolutely uniform and 100% efficient.

What It Does:

KORDEK produces castings of the highest grade with the smallest percentage of blowholes and imperfections—

makes cores that have sharp edges and keep them—

bakes in the shortest time—

bakes at the lowest temperature—

increases in strength while baking—

stands up when metal is poured—

leaves a clean core box—

breaks out of castings with greatest ease—

gives off the least smoke and gas—

may be mixed in large quantities, and used as needed—

CORN PRODUCTS REFINING CO.

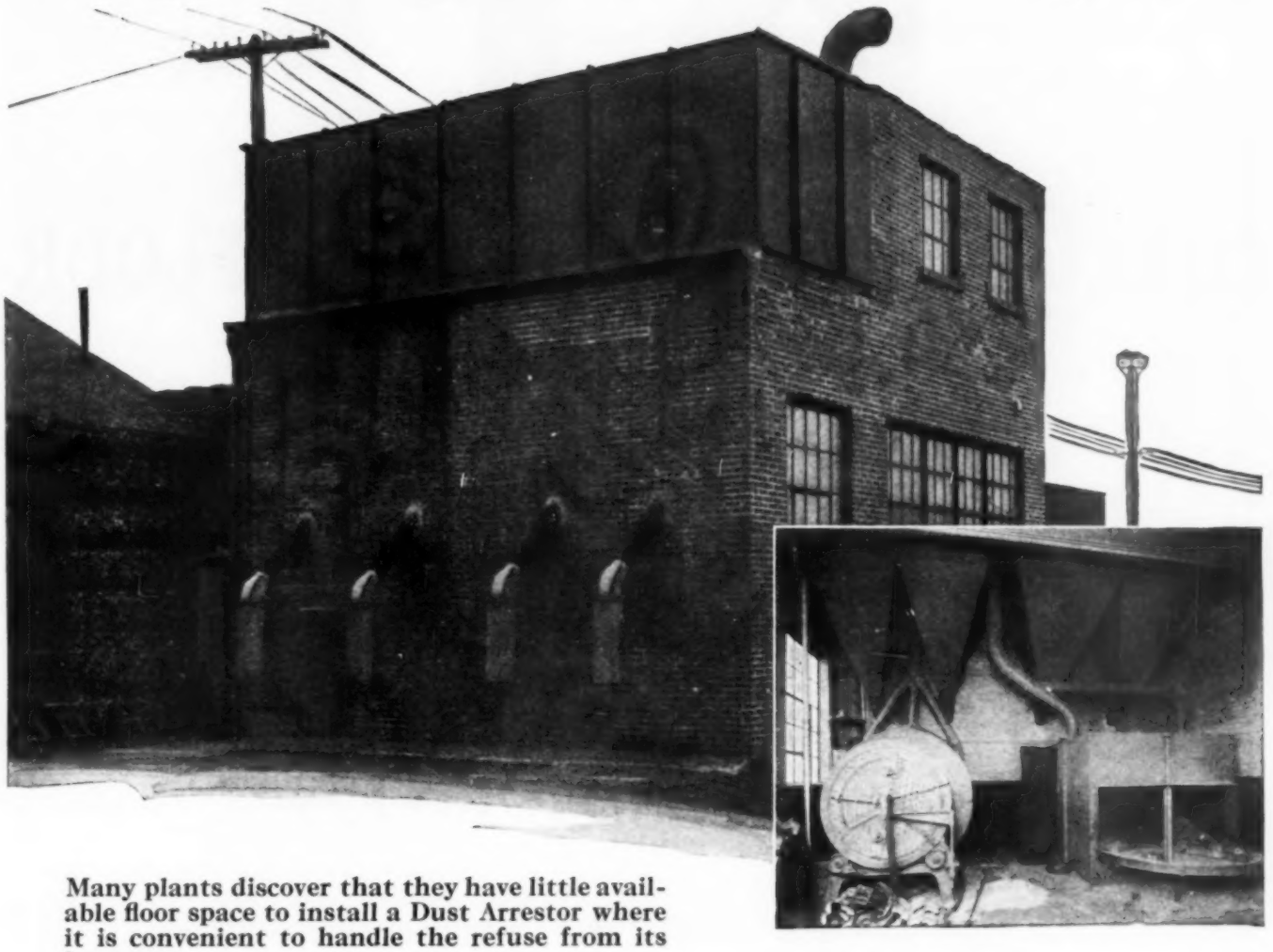
17 Battery Place **New York, N.Y.**

KORDEK

Reg. U. S. Pat. Off.

*3

A Large Dust Arrestor Requiring No Floor Space



Many plants discover that they have little available floor space to install a Dust Arrestor where it is convenient to handle the refuse from its hoppers.

The above illustration shows an installation where a New Haven Bag Type Dust Arrestor is built into a building and has angled hoppers which discharge outside.

The cut on right shows an interior view of this same Arrestor. Note the hoppers projecting thru side wall. This arrangement permitted the use of floor space below for the installation of a New Haven 48" sandblast barrel and 8' rotary table room.

This installation not only handles dust from the New Haven 48" sandblast barrel and 8' rotary table, but from a battery of 22 mills and 6 grinders in an adjoining room.

The Arrestor is our new bag type with flat bags nested as closely as screens, enabling flexible suspension and shaking of bags, and with our latest type of bag attachment, permitting the replacement of a bag in ten minutes.

"Quality Equipment Pays In The End"

THE NEW HAVEN SAND BLAST CO.

SANDBLAST BARRELS — ROOMS — CABINETS — TABLES — DUST ARRESTORS

New Haven, Conn. Cleveland, Ohio.

K-B

CORE BINDER and FACING FLOUR

Costs No More—

than other flour binders and is—

Less Expensive To Use

This appears to be the verdict of a large number of foundries who express their preference for the K-B quality.

By following this quality leadership you can produce better cores at a minimum cost and figure savings in other connections.

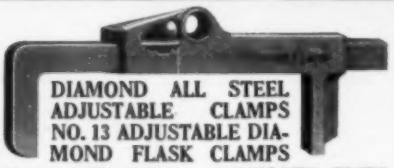
There is satisfaction and profit assured to every purchaser of this product—Can we be of service to your company?

Knefler-Bates Manufacturing Co., Indianapolis, Ind.

Distributing Warehouses located in all principal American Cities.
Agents for Great Britain: Yorkshire Amalgamated Products, Ltd., 27 Waterdale, Doncaster, England.

Agents for Scandinavian countries: Otto Madsen, Copenhagen, Denmark.

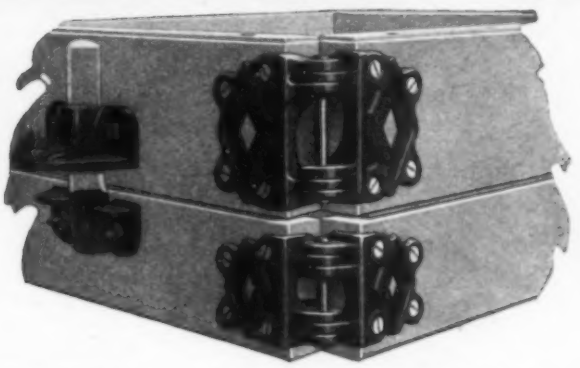
Buy from One Source SAVE Time and Money



DIAMOND ALL STEEL ADJUSTABLE CLAMPS NO. 13 ADJUSTABLE DIAMOND FLASK CLAMPS

$19.20 PER DOZEN, COMPLETE WITH BAR IRON

The oldest, most reliable clamps on the market. Strength and rigidity absolutely permit of rapid changes of sizes—essentially for heavy duty. Other sizes priced accordingly. The kind you need and want. See our Catalog No. 20 for sizes.



STRAIGHT SIDE DIAMOND MASTER SNAP FLASKS 72" TO 84" $15.60 EACH—TAPER SIDE $1.20 EXTRA—3 PART FLASKS 50% ADDITIONAL

DRAGS, CHEEKS OR COPES 6" DEEP OR LARGER NET EXTRA $1.00 PER PART

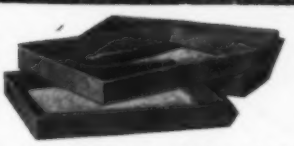
Diamond Snap Flasks, made by the pioneers of snap molding equipment, are specially selected cherry wood, with heavy malleable fittings of special design, straight or taper side, right or left hand, with quick centering Style "A" Pins, 2 or 3 parts, and in sizes up to 84" and over.

They are fully guaranteed against defects in material and workmanship, and are longest-lasting and most economical—they apply equally well on bench, floor, molding machine or squeezer work.

Write us for sizes, prices and quantity discounts.

MALLEABLE SHAKEOUT TONGS SPECIALLY PRICED AT $10.00 PER DOZEN

Diamond "Shakeout Tongs"—the long-lasting kind, strong enough to withstand the most severe service. If your molders once use them, they will use no others—***specially priced at $10.00 per dozen.***

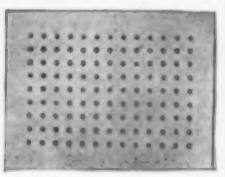


Steel Bands Specially Priced On All Sizes 48" x 1½" to 84" x 4". ⅛" and $\frac{1}{16}$" Steel.

Made of band steel, braked to accurate dimensions, and spot welded. They hold their shape, despite hard usage. All sizes shipped from stock.

Size 72" x 3½" x ⅛" $.72 Each!

DIAMOND STEEL CORE PLATES 336 Sq. In. $2.16 EACH SPECIAL PRICES ON QUANTITY ORDERS —OTHER SIZES 144-784 Sq. In. AT SIMILAR PRICES



Core plates cannot warp or burn; made of rust-resisting steel. They are light and easy to handle, and save time and space.

Order now—special prices on quantity orders —immediate shipment on standard sizes.

DIAMOND STEEL MOLD JACKETS STYLE I—SIZE 60" x 9" $5.40 EACH SEE CATALOG FOR OTHER STYLES AND LOW PRICES

When slipped over the mold, they take a position with equal pressure on all sides, being practically indestructible, and retaining shape under most severe conditions; will not warp or buckle when subjected to heat. They're made to last.

Standardize on the Diamond Line. Why buy a band from one source, and mold jackets from another, when the grouping of your purchases and standardization on Diamond Molding Equipment bring you guaranteed products, same day shipment service on all standard parts, quantity discounts, and knowledge of your requirements, plus personal attention to your needs? We have specialized in Foundry Equipment since 1889—a good guarantee of ability to meet your needs with quality products.

It is to your advantage to buy Diamond Equipment now, because our production facilities have been increased, in this way forcing lower selling costs. Send in your inquiries and orders today for Steel Bands, Flask and Pattern Makers' Clamps, Core and Bottom Plates, Core Boxes, Snap Flasks, Mold Jackets, Pinch Dogs, Rapping Plates, Shakeout Tongs, Hard Wood Wedges, etc.

If you haven't a copy of our Catalog No. 20, we will gladly send one on request.

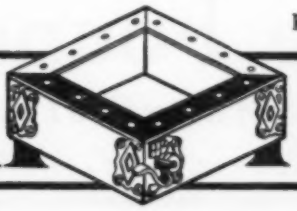
Diamond Clamp & Flask Company

30-40 North 14th Street

Richmond, Indiana

Chicago Office:

Peoples Gas Bldg. Tel. Harr. 7071



DIAMOND

The Fastest Way To Make Pattern Mounts

TWO BROTHERS

Pouring a Match

With

MENCO Pattern Compound

These two men have made hundreds of MENCO Pattern Mounts. Some Pattern Mounts have been in use for more than eight years.

MENCO

Pattern Compound

What MENCO Is:

A Compound mixed in water that gives an exact duplicate of your pattern, at a very low cost.

Special Trial Offer:

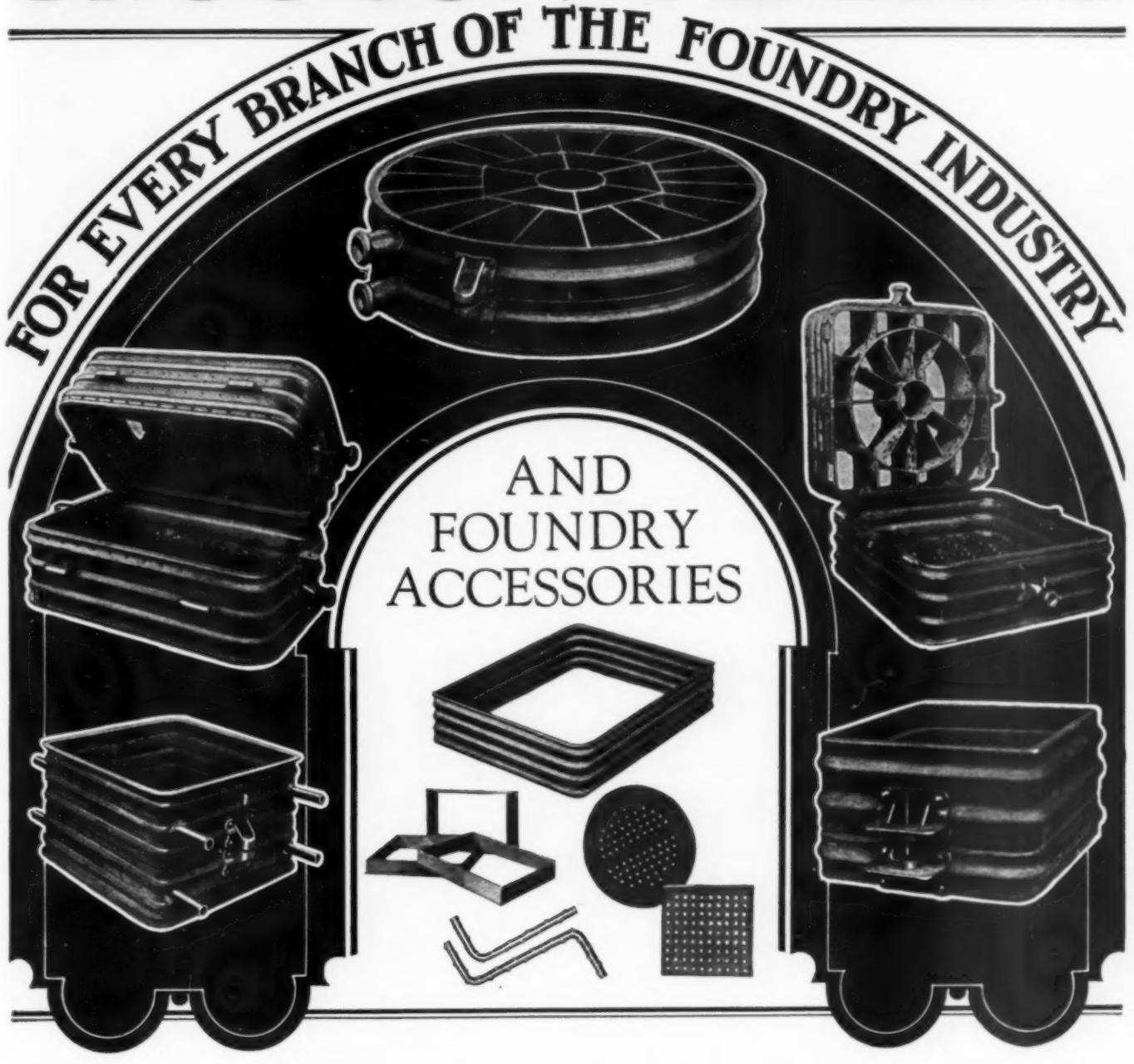
Our price on one barrel of MENCO weighing 300 lbs. is 12c per pound. A 100 lb. order sells at 15c per pound. During this month we will accept a 100 lb. order at 12c per pound.

The Menefee Foundry Co. Inc.

Sole Manufacturers

Fort Wayne **Indiana**

TRUSCON FLASKS



You Can Depend on Steady Service

Truscon Flasks assure uninterrupted service because they are built to stand up under heavy usage. Whether flasks are small or large they receive the same high grade of workmanship and are thoroughly inspected before delivery. Truscon experience dates back a great number of years and Truscon has always pioneered the most modern and practical features. A trial order will convince you.

TRUSCON STEEL COMPANY, - - - YOUNGSTOWN, OHIO

WAREHOUSES AND OFFICES IN ALL PRINCIPAL CITIES

Results Count

Your knowledge of foundry practice coupled with our knowledge of oils as evidenced by nine grades of

Will give you the results you desire

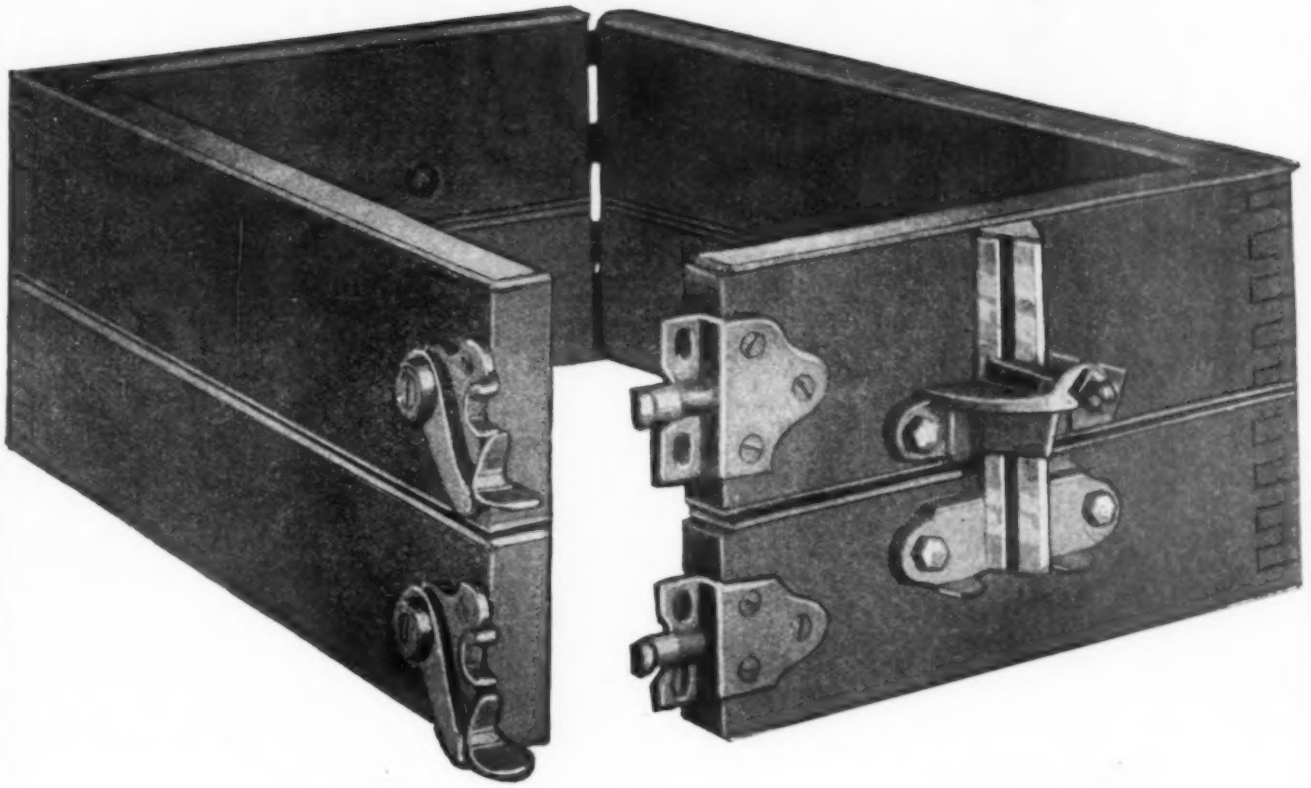
Ask us to prove it

Wm. C. Robinson & Son Co.
Baltimore, Md.

BOSTON
NEW YORK
PHILADELPHIA
PITTSBURGH
CHICAGO
DETROIT
NORFOLK
CHARLOTTE

ARCADE MOLDING MACHINES AND FOUNDRY EQUIPMENT

A Rugged Flask For Hard Knocks



Selected cherry
Certified malleable hinges and locks
Iron top and bottom and in each side of the joint
Made both straight side and tapered
Bench, squeezer, or machine

Milled pins and ears
Accuracy

Ask for Bulletin 31-I *Your Copy is ready*

Also Molding Machines, Pouring Devices, and other Foundry Equipment

Arcade Manufacturing Company **Freeport, Illinois U. S. A.**

2

THOUSANDS of Cores have been made, baked and broken, in the Lindsay-McMillan laboratories, in developing the present complete line of Delco Core Oils.

No guesswork. When you require a Core Oil for a particular casting need—whether it be for steel, semi-steel, grey iron, malleable iron, bronze, brass, aluminum, or any Standard alloy, you find a Delco Core Oil "tailor-made" for the job.

Delco Core Oils are used by many of the foremost foundries. At your request, our laboratories will be more than pleased to furnish details—to co-operate heartily in your work. Why not write us today?

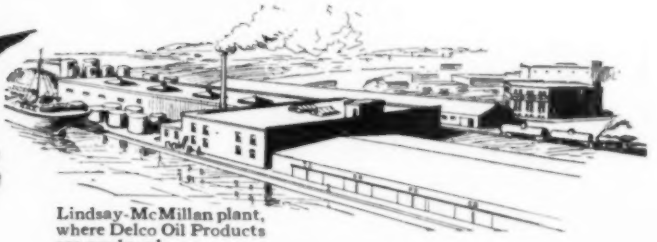
Rosinal
ROSIN IN SOLUTION

Lindsay-McMillan's greatest contribution to the foundry industry. Pure rosin for the first time in perfect solution! And in a medium that completely disappears in baking. Get the facts.

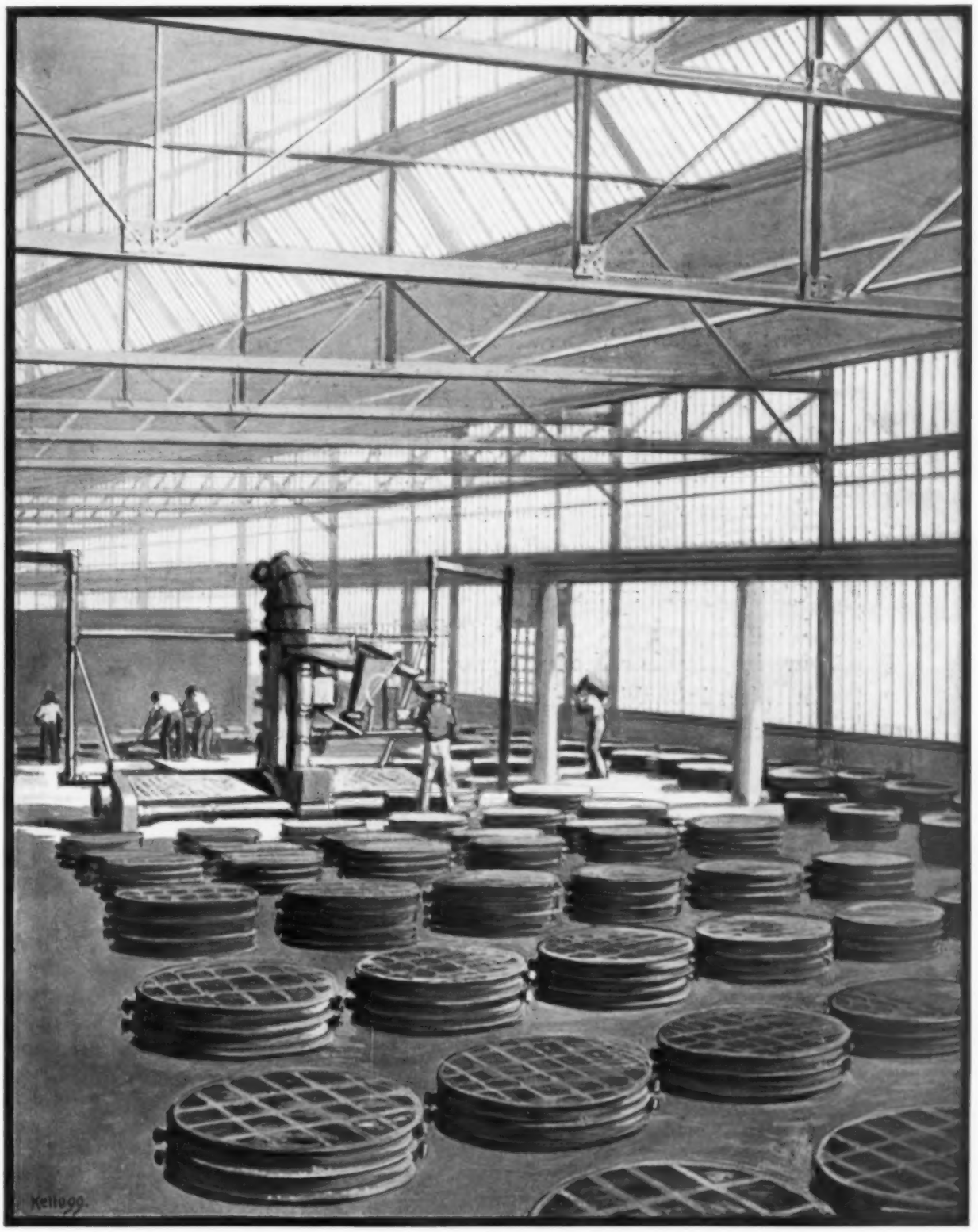
LINDSAY-McMILLAN Co. **MILWAUKEE**

Branch Offices:
Chicago, 1605 Kimball Building *Detroit, 3131 Bellevue Avenue*
Minneapolis, Central Warehouse Company

Delco Core Oils



Lindsay-McMillan plant, where Delco Oil Products are produced.



A STORY OF WHAT THE BETTER METHOD IS ACCOMPLISHING IN THE FOUNDRY PICTURED ABOVE WILL BE FOUND ON THE NEXT PAGE.

In this production foundry, it is the making of more molds per square foot of floor space without the corresponding increase in man power that effects reductions in plant overhead, and increases the capacity of every man on the molding floor. The Better Method, in production or jobbing shops, coordinates all operations, absorbs peak load requirements, eliminates chaotic labor conditions, forces a more orderly production, and is lowest in cost, regardless of conditions.

SANDSLINGERS CAN NOW BE SEEN IN OPERATION IN ALL TYPES OF FOUNDRIES. AND ON ALL CLASSES OF WORK. THERE IS PROBABLY AN INSTALLATION IN YOUR VICINITY THAT WILL INTEREST YOU LET US ARRANGE FOR YOU TO TALK TO A USER. AND GET THE FACTS ABOUT THE BETTER METHOD OF MOLDING

The Cleveland Cooperative Stove Company operates one of the most modern and best equipped production foundries in the country (shop view shown on other side). One Tractor Type *Sandslinger* rams 150 molds with 7 pattern changes in a 6 hour working day, a crew of 7 men setting up, ramming, finishing and pouring.

Cleaning and assembling costs have been decidedly lowered, castings have a better finish, common labor has improved on the hand ramming results of skilled molders in making thin section furnace castings, and the cost of production has been reduced 65 per cent.

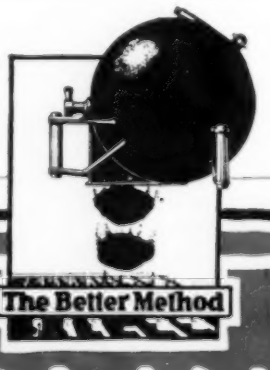
BETTER METHODS, our monthly newspaper, sent free on request to interested foundrymen, reviews representative installations of the Better Method, outlines the application, and describes the economies effected over previous molding practices. If you do not receive it regularly, write us, and we'll reserve a copy for you.

THE BEARDSLEY & PIPER COMPANY

Manufacturers of Sand Conditioning, Conveying and Molding Equipment

2541 N. Keeler Avenue, Chicago

Representatives in Principal Foreign Countries



SANDSLINGERS

Profitable Expenditures —

Adams Steel Jacket

Don't forget that a mold represents no value until it is poured. Safeguard your production with Adams Steel Jackets.

Flask equipment is a comparatively small item in the list of equipment expenditures, yet it is of paramount importance when output and quality of product are considered.

Taking into consideration their beneficial effects on production and efficiency, the purchase of Adams Cherry Snap Flasks can properly be termed "Profitable Expenditures".

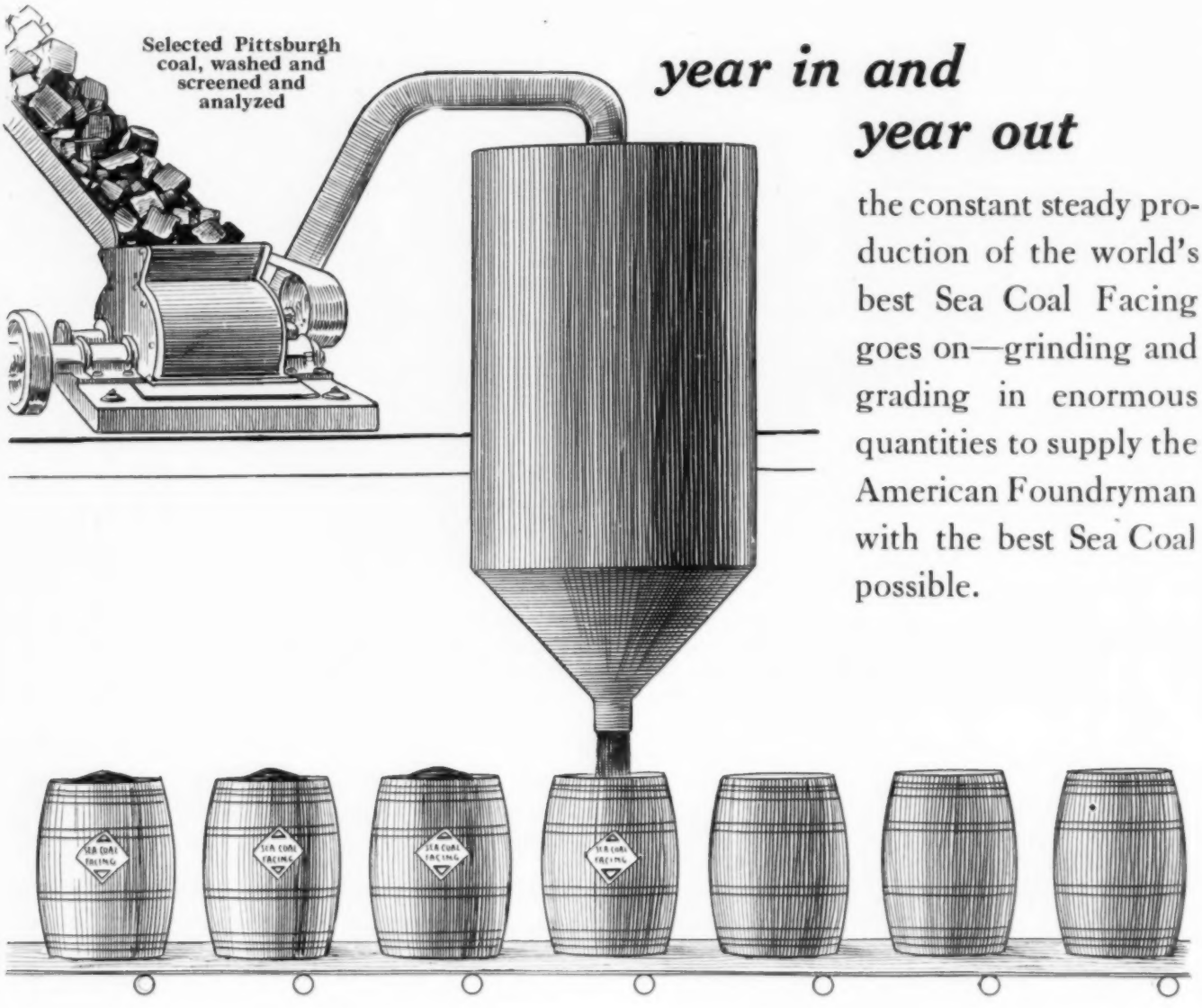
High grade cherry lumber and malleable trimmings are used exclusively. Machine locked corners and one-piece irons are assurance of rigidity and permanent alignment.

Trimmings are of exclusive design, and have simple adjustments to compensate for wear.

Available in any size, shape or style your work demands.

The Adams Company, Est. 1883 — 170 Foster Street, DUBUQUE, IOWA, U. S. A.

The Mills of McCormick grind slowly but sure!



year in and year out

the constant steady production of the world's best Sea Coal Facing goes on—grinding and grading in enormous quantities to supply the American Foundryman with the best Sea Coal possible.

It pays to buy in carlots--

lower price of material and lower freight charges.
Look into this—then order the GOOD Sea Coal
from the manufacturers

J. S. McCormick Co. Foundry Supplies
Pittsburgh, Pa.

Where cost sheets show low costs

you'll find

COLEMAN
CORE & MOLD OVENS

In the foremost foundries noted for their efficient operation, Coleman Ovens play an important part in meeting the present day economic need for low cost production.

Coleman Ovens provide increased production of better quality at lower cost for fuel, labor and maintenance.

It will pay you to investigate the cost-cutting possibilities of Coleman core and mold ovens to meet your own operating conditions.

Write today for new Coleman Oven Catalog F.

Some Users of

COLEMAN

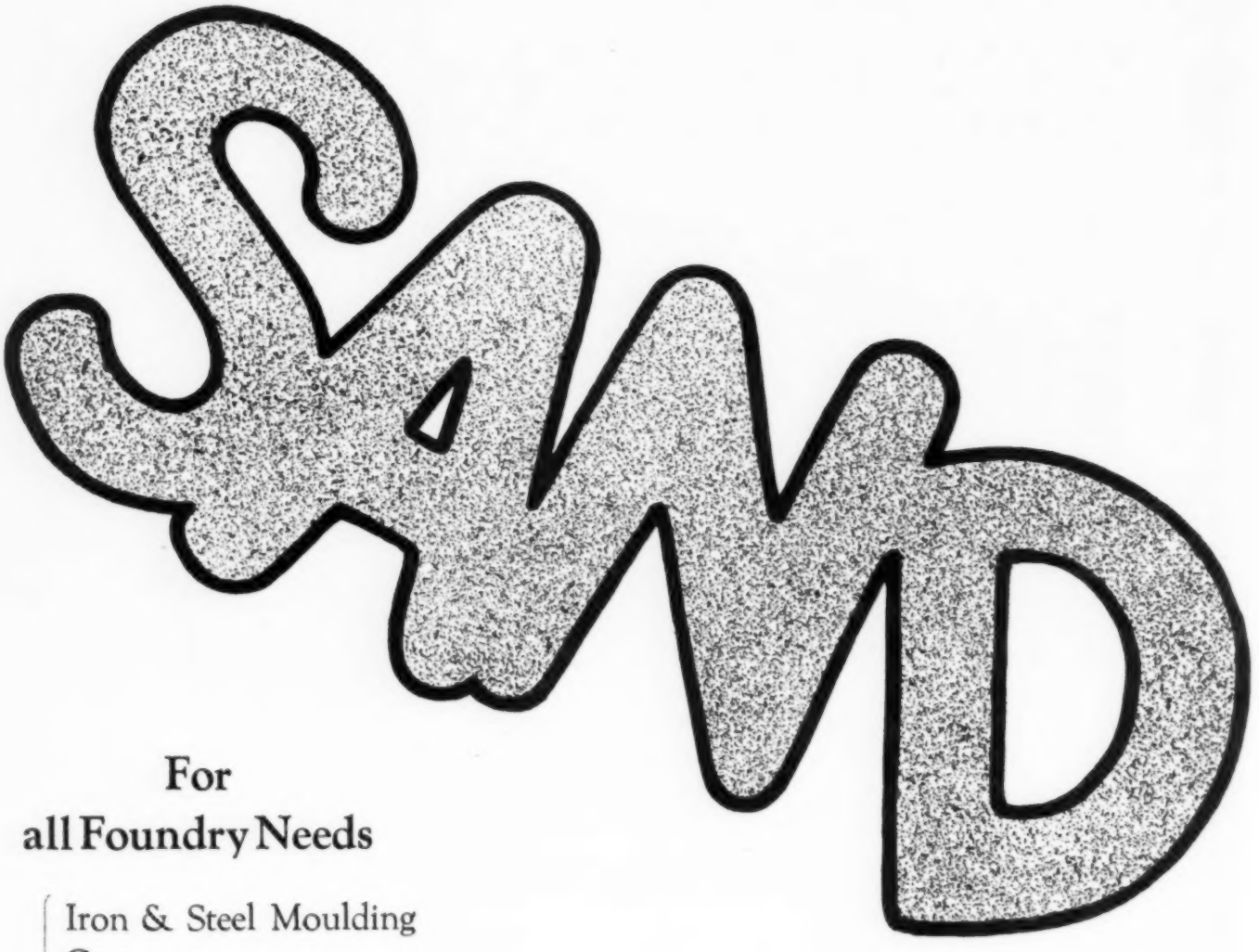
CORE & MOLD OVENS

Allis Chalmers Mfg. Co.
American Car & Foundry Co.
American Foundry Co.
American Locomotive Co.
American Radiator Co.
Belle City Malleable Iron Co.
Bucyrus Co.
Buick Motor Co.
Burnham Boiler Corp.
Cadillac Motor Car Co.
Chapman Valve Co.
Chicago Hardware Fdy. Co.
Columbia Radiator Co.
Continental Gin Co.
Cramp Ship Yards & Engine Co.
Detroit Lubricator Co.
Electric Vacuum Cleaner Co.
Fairbanks, Morse & Co.
Falk Corporation
Frick Co., Inc.
Fulton Iron Works Co.
General Electric Co.
General Fire Extinguisher Co.
Gisholt Machine Co.
Holland Furnace Co.
International Harvester Co.
International Motor Co.
Kensington Davis Corp.
Lewis Foundry & Machine Co.
Lorain Steel Co.
Lycoming Motors Corp.
H. Mueller Mfg. Co.
Norfolk & Western R. R.
Norfolk Navy Yard
Otis Elevator Co.
Otis Steel Co.
Pawling & Harnischfeger Co.
Philadelphia Navy Yard
Wm. Powell Co.
Power Specialty Co.
Pratt & Cady Co.
Pratt & Letchworth Co.
H. B. Smith Co.
Standard Foundry Co.
Standard Sanitary Mfg. Co.
U. S. Cast Iron Pipe & Fdy. Co.
Union Radiator Co.
Waterbury Farrel Fdy. & Mch. Co.
Western Foundry Co.
Westinghouse Air-Brake Co.
Westinghouse Electric & Mfg. Co.
Whitin Machine Works
Wolverine Brass Works
Wolff Mfg. Corporation
Worthington Pump & Mach. Corp.

The FOUNDRY EQUIPMENT Co.

Builders of Foundry Ovens & Furnaces
Contracting Engineers *and* Manufacturers
CLEVELAND, OHIO

Industrial Minerals Company and its Distributors Wish you a Happy Christmas and a Prosperous New Year.



For all Foundry Needs

Iron & Steel Moulding
Core
Cleaning
Silica Wash

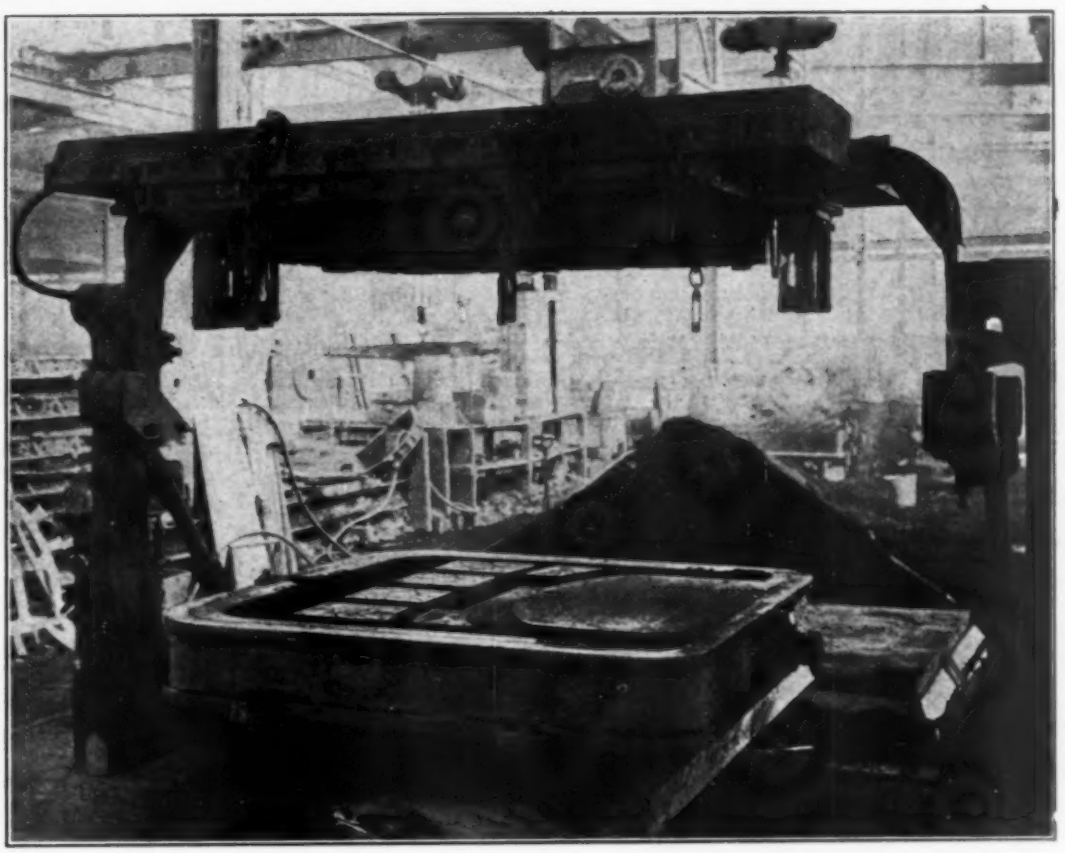
Home Office

277 East Long St.
Columbus, Ohio

Western Distributors

Carpenter Bros., Milwaukee, Wis.
Manley Sand Co., Rockton, Ill.

If It's A Herman It's Worth Using. It Made Its Way by the Way it's Made



Boiler Section Work made on Herman Machines

Herman Jar Independent Rollover and Pattern Drawing Machines put *speed and efficiency* into such work as boiler sections, engine beds, cast iron columns, machine tool frames, cylinders, and all other work of medium or larger nature. *Ask users—they'll convince you.*

May we have your inquiry? Our Service Department will gladly advise you on your molding machine requirements for such work. This service is free of cost or obligation.

Herman Pneumatic Machine Company

GENERAL OFFICES: Union Bank Building, PITTSBURGH, PA.
MANUFACTURING PLANT: ZELIENOPLE, PENNSYLVANIA, U. S. A
Foreign Works: Pneumatic Engineering Appliances Co., Ltd., Palace Chambers, Westminster, London, S. W., Eng.

Cut Expenses and Increase Profits

Use The Speedy Reliable Universal Riddle

Convenient portable stand for Riddle. Price $25.00.

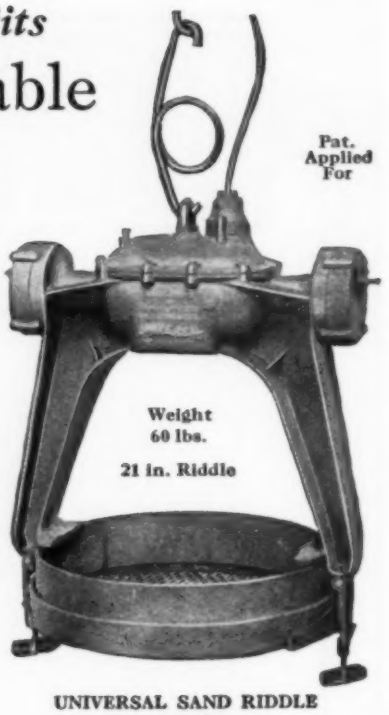
Easily handled by one man: weight 60 lbs. Riddle 21 inch: mesh according to requirements. May be used on any hook or trolley. Two wire Riddles provided with safety ground wire.
No additional cost for 3 phase or direct current motors. Please give the correct current when ordering.

Price $150.00 f.o.b. Chicago

For the Most Reliable Service at the Lowest Operating Cost

USE the RED ELECTRIC VIBRATOR

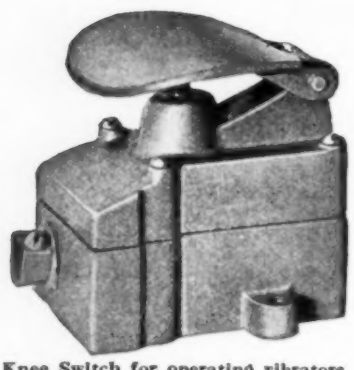
Manufactured in four sizes, consecutively doubled in capacity.
No. 1 Vibrator for light match plates.....**$10.00**
No. 2 Vibrator for medium match plates.....**$13.00**
No. 5 Vibrator for heavy match plates, tub and bench work.....**$17.00**
No. 9 Vibrator for machine and heavier work, **$21.00** without cable: **$24.00** with cable.
Vibrators provided with third safety ground wire in accordance with the U. S. Government Code, $1.00 extra. No extra charge for No. 9 Vibrator. Be sure to give correct voltage and cycle when ordering.



UNIVERSAL SAND RIDDLE

No. 5 Vibrator (improved No. 4) is used for bench, tub and heavy match plate work. It is double the capacity of the No. 2 Vibrator. Price $17.00.

No. 5 and No. 9 Aluminum Brackets for fastening No. 5 and No. 9 Vibrators to skids for tub use or to ordinary bench. Very effective for match plate and other work. Price of Bracket including screws and bolt for fastening, $5.50.



Knee Switch for operating vibrators.
Single pole Switch..... $3.00
Double pole Switch..... $3.50

No. 9 Vibrator (improved No. 8) is double the capacity of the No. 5 and may be used for machine work or where heavier vibration is required.

Price $21.00 without cable: $24.00 with cable.

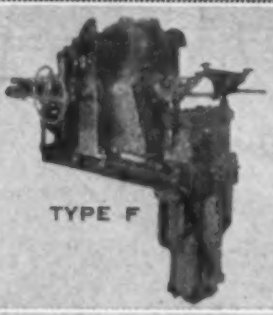
Order from your supply house today

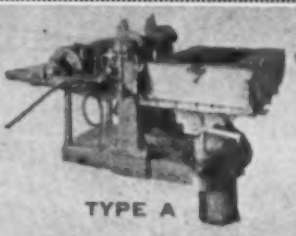
FOUNDRY SUPPLIES MFG. CO.

2221 Orchard St., Chicago, Ill., U. S. A.

TYPE M

TYPE R
CORE SPECIAL


TYPE F


TYPE A

TYPE JHL

TYPE HJ

INTERNATIONAL
MOLDING MACHINES

TYPE A	HAND RAMMING POWER TURN-OVER POWER DRAW MACHINE.
TYPE C	POWER SQUEEZER POWER STRIPPING MACHINE.
TYPE F	JAR RAMMING POWER TURN-OVER POWER DRAW MACHINE.
TYPE G	JAR RAMMING POWER TURN-OVER FOOT DRAW MACHINE.
TYPE GR	HAND RAMMING POWER TURN-OVER FOOT DRAW MACHINE.
TYPE H	POWER SQUEEZER.
TYPE HJ	JAR RAMMING HAND TURN-OVER FOOT DRAW MACHINE.
TYPE J	JARRING MACHINE.
TYPE JHL	JARRING MACHINE WITH HAND LEVER LIFT.
TYPE JL	JARRING MACHINE WITH AIR LIFTING CYLINDERS.
TYPE JS	JOLT SQUEEZER.
TYPE JW	JAR RAMMING HAND STRIPPING MACHINE.
TYPE JWP	JAR RAMMING POWER STRIPPING MACHINE.
TYPE K	JOLT SQUEEZER POWER STRIPPING MACHINE.
TYPE M	JAR RAMMING HAND TURN-OVER FOOT DRAW MACHINE.
TYPE R	HAND RAMMING HAND TURN-OVER FOOT DRAW MACHINE.
TYPE R	CORE SPECIAL TURN-OVER DRAW MACHINE.
TYPE R	SPECIAL HAND RAMMING POWER TURN-OVER FOOT DRAW MACHINE.
TYPE T	HAND STRIPPING PLATE MACHINE — FOR SMALL WORK.
TYPE TJ	JAR RAMMING POWER STRIPPING MACHINE.
TYPE Y	HAND STRIPPING PLATE MACHINE — FOR LARGE WORK.

INTERNATIONAL MOLDING MACHINE CO.
2608-2624 W. 16TH ST. : CHICAGO, ILL.

TYPE JW

TYPE JWP

TYPE JL

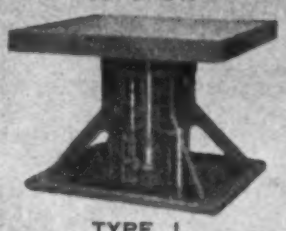
TYPE R

TYPE R SPECIAL

TYPE G

TYPE GR

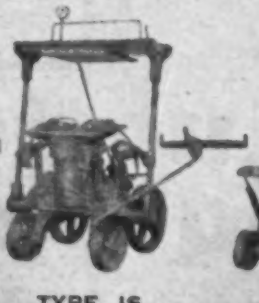
TYPE TJ


TYPE J

TYPE T

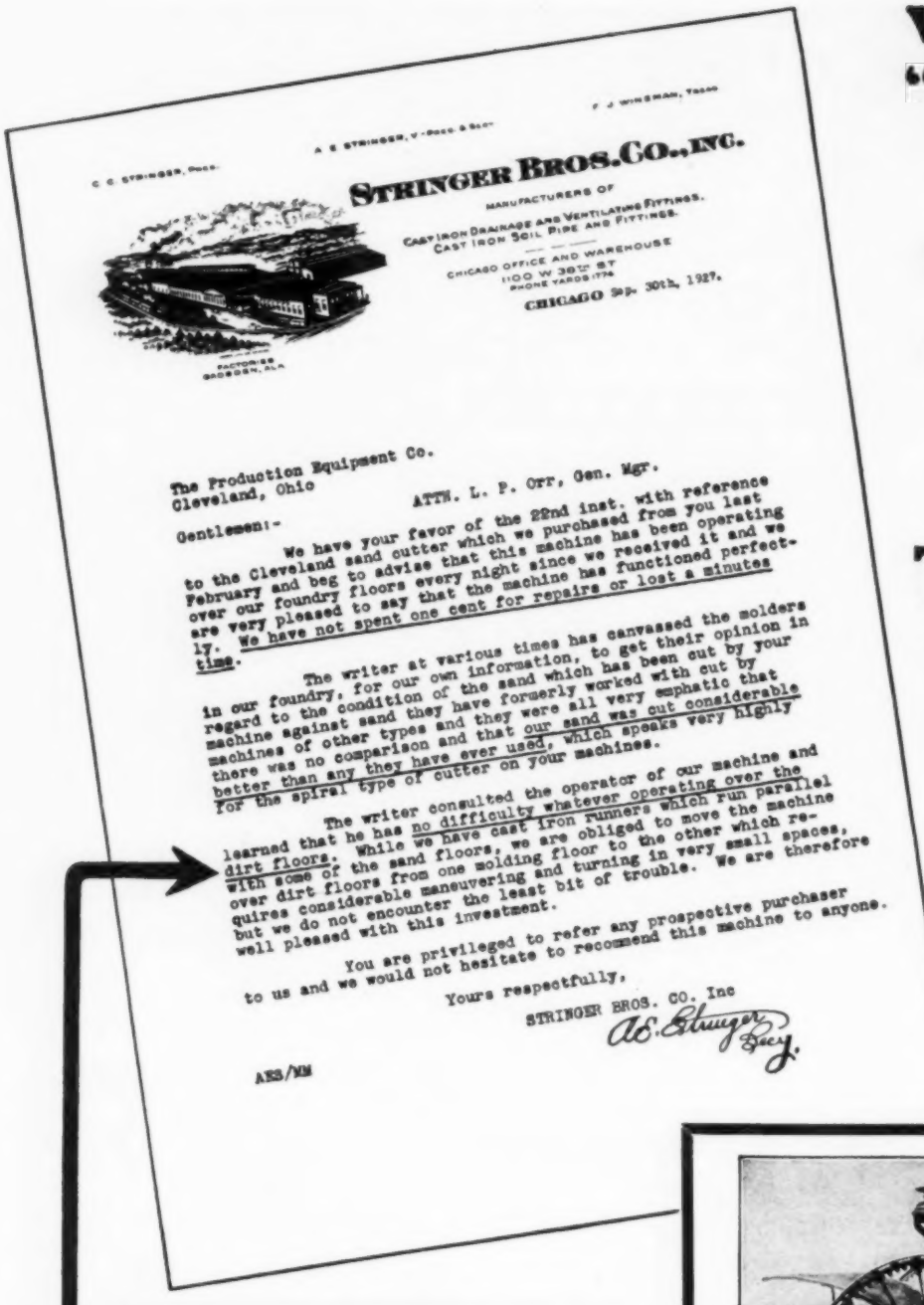
TYPE C

TYPE K


TYPE JS

TYPE H

TYPE Y



STRINGER BROS. CO., INC.

MANUFACTURERS OF
CAST IRON DRAINAGE AND VENTILATING FITTINGS.
CAST IRON SOIL PIPE AND FITTINGS.

CHICAGO OFFICE AND WAREHOUSE
1100 W 38TH ST
PHONE YARDS 1774

CHICAGO Sept. 30th, 1927.

The Production Equipment Co.
Cleveland, Ohio

ATTN. L. P. Orr, Gen. Mgr.

Gentlemen:-

We have your favor of the 22nd inst. with reference to the Cleveland sand cutter which we purchased from you last February and beg to advise that this machine has been operating over our foundry floors every night since we received it and we are very pleased to say that the machine has functioned perfectly. We have not spent one cent for repairs or lost a minutes time.

The writer at various times has canvassed the molders in our foundry, for our own information, to get their opinion in regard to the condition of the sand which has been cut by your machine against sand they have formerly worked with cut by machines of other types and they were all very emphatic that there was no comparison and that our sand was cut considerable better than any they have ever used, which speaks very highly for the spiral type of cutter on your machines.

The writer consulted the operator of our machine and learned that he has no difficulty whatever operating over the dirt floors. While we have cast iron runners which run parallel with some of the sand floors, we are obliged to move the machine over dirt floors from one molding floor to the other which requires considerable maneuvering and turning in very small spaces, but we do not encounter the least bit of trouble. We are therefore well pleased with this investment.

You are privileged to refer any prospective purchaser to us and we would not hesitate to recommend this machine to anyone.

Yours respectfully,

STRINGER BROS. CO. Inc

A.S. Stringer Secy.

AES/MM

Why So Many "CLEVELAND" Sandcutters Replace Other Makes

REASON No. 9

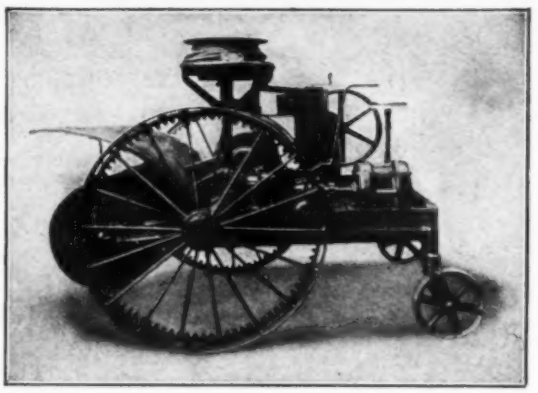
Easily Operated on Soft Floors

THE wide-tread wheels and even distribution of weight make it possible for CLEVELANDS to operate on all types of floors.

CLEVELAND SAND CUTTER

TRADE MARK

"NO DIFFICULTY IN OPERATING OVER THE DIRT FLOORS"



CLEVELAND Sandcutter, Model C
—the type referred to in letter.

The Production Equipment Co.

5213 Windsor Ave., Cleveland

The Titanium Alloy Manufacturing Co.

Niagara Falls, N. Y., U.S.A.

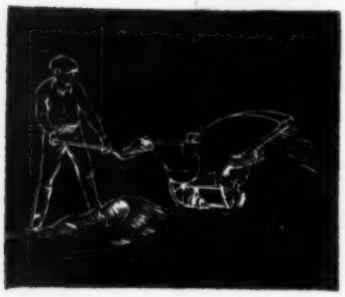
BRANCH OFFICES:
94 FULTON ST., NEW YORK
OLIVER BUILDING, PITTSBURGH
6007 EUCLID AVE., CLEVELAND

FERRO CARBON TITANIUM
Reg. U.S.Pat. OFFICE
TRADE MARK
F.C.T.

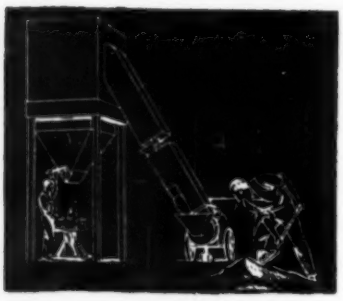
AGENTS FOR
GREAT BRITAIN AND EUROPE
T. ROWLANDS & CO., LTD.
SHEFFIELD, ENG.

"Best Conditioned Sand"
"Labor Reduced One-Half"

AXMANN Universal Sand-Thrower discharging sand through back chute.



AXMANN Universal Sand-Thrower discharging sand through side chute.



AXMANN Universal Sand-Thrower discharging sand through upward chute to sand hopper.

McMYLER INTERSTATE CO., BEDFORD, OHIO
AXMANN machine serving large roll-over molding machine. Returns sand from shake-out location, perfectly conditioned and aerated in one operation.

AXMANN
Universal Sand-Thrower

Mr. H. W. Farris, foundry superintendant of the McMyler Interstate Co., states that in his twenty-five years of foundry experience he has never obtained such well conditioned sand, either by hand or machine as he is now obtaining with the AXMANN Universal.

The AXMANN Universal Sand-Thrower in one operation thoroughly blends, mixes, aerates, conditions, breaks up lumps, and discharges foundry sand in a fluffy stream of uniform temper.

Remember,—better sand means better castings. It will pay you to investigate the AXMANN.

Write today for complete Bulletin No. 11.

The Axmann Sand-Throwing Machine Company

1833 COLUMBUS RD.
CLEVELAND, OHIO

—for MAKING BETTER IRON CASTINGS

TRADE MARK

Mayari Pig Iron

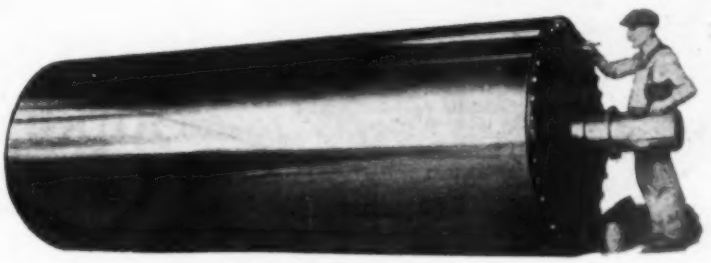
Types of Iron Castings improved with Mayari

General Jobbing Castings
Locomotive Castings
Gear Blanks
Machine Tool Beds
Machine Tool Tables
Steam and Hydraulic Cylinders
Diesel Engine Cylinders
Liners and Pistons
Ammonia Cylinders
Acetylene Cylinders
Valves and Hydrants
Tractor Castings
Tire Moulds and Cores
Glass Moulds and Plungers
Steam Shovel Castings
Fuel Economizers
Printing Press Rolls
Concrete Mixers
Air Compressors
Marine Engine
Steam Hammers
Electric Refrigerator Cylinders

White Iron Grinding Plate

Small Slag Pot

Duplex Oil Strainer Casting



Highly Polished Paper Drying Roll

MAYARI Pig Iron is a natural nickel-chromium iron made by the blast furnace process direct from the alloy-bearing ore.

Small percentages of Mayari are added to the cupola mixture. In the melting it becomes thoroughly distributed throughout the metal with excellent alloying results. The alloys in Mayari break up the graphite crystals of the irons of the mixture, producing fine-grain, tough, strong and clean castings.

Mayari permits the pouring of very hot iron and adds fluidity to the metal, thereby making possible the casting of thin-walled, intricately shaped castings as well as the pouring of large sections with thick and thin walls which require uniform texture of iron.

Book 'Mayari Pig Iron' sent on request

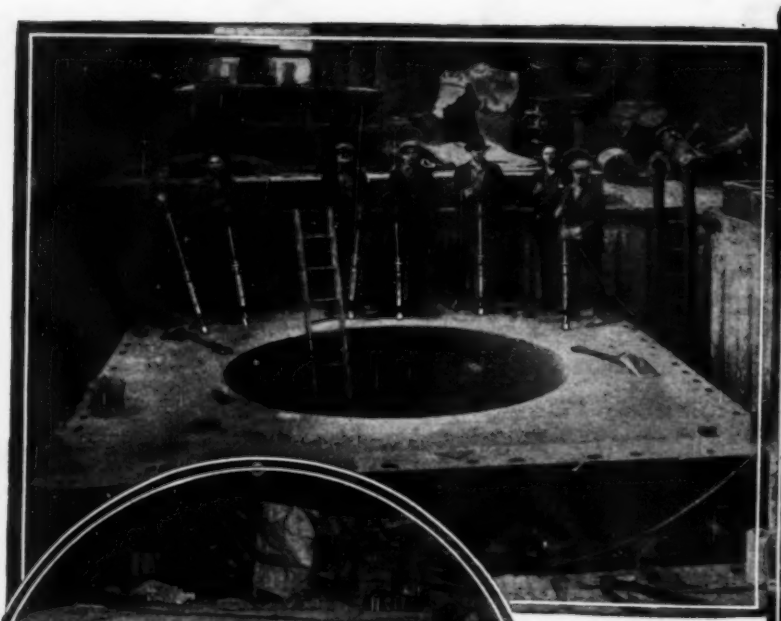
BETHLEHEM STEEL COMPANY—*General Offices:* BETHLEHEM, PA.

District Offices:

New York, Cunard Bldg.
Boston, Atlantic Nat. Bank Bldg.
Philadelphia, Widener Bldg.
Baltimore, Continental Bldg.
Washington, Wilkins Bldg.
Atlanta, Healey Bldg.
Pittsburgh, Oliver Bldg.
Buffalo, Marine Trust Bldg.
Cleveland, Union Trust Bldg.
Cincinnati, Union Trust Bldg.
Detroit, Penobscot Bldg.
Chicago, Peoples Gas Bldg.
St. Louis, Arcade Bldg.
Los Angeles, Pacific Finance Bldg.
San Francisco, Matson Bldg.
Seattle, L. C. Smith Bldg.
Portland, Northwestern Bk. Bldg.

BETHLEHEM STEEL EXPORT CORPORATION, 25 BROADWAY, NEW YORK CITY *Sole Exporter of our Commercial Products*

BETHLEHEM



Boyer Superior Type "A" Sand Rammers used on mold.

The 425,000 lb. retort ready for the annealing furnace.

Boyer Superior Type "A" Sand Rammers in operation.

Boyer Superior Sand Rammers Insure Even Molds

Boyer Superior Type "A" Rammer

THE Boyer Superior Type "A" Sand Rammers shown above were used exclusively in ramming the mold for the 425,000 lb. retort casting illustrated. Due to the excellent mold and general high character of manufacturing practice, the casting came clean from the mold. No chipping was required, and the casting was taken direct to the annealing furnace.

Speed of operation, compact ramming, and lack of vibration have caused this steel plant, one of the largest in the country, to standardize on Boyer Superior Type "A" Sand Rammers.

Boyer Superior Type "A" Sand Rammers strike 800 blows per minute, and meet the heaviest class of foundry sand ramming demands. Let us demonstrate under your own conditions.

P 281

Chicago Pneumatic Tool Co.

Sales and Service Branches all over the World

6 East 44th St. New York, N. Y.

Find Out!

How Brass Foundries are using Nickel

IMPROVEMENTS in foundry practice do not spring full-fledged from the minds of their originators. Trial precedes perfection—experiment antedates adoption—Brass Foundries study the available information about Nickel additions before making such additions standard practice.

Out of all the discussion concerning the value of Nickel—from the experimentation—from the search for facts—there has grown data that point the way to outstanding improvements in non-ferrous castings.

These improvements are roughly outlined in the adjacent panel as are also the types of castings in which Nickel can be successfully employed. This information is amplified and given with greater detail in the booklet, "The Use of Nickel in the Brass Foundry". Send for your copy today!

Present-day foundrymen are making Nickel additions to:

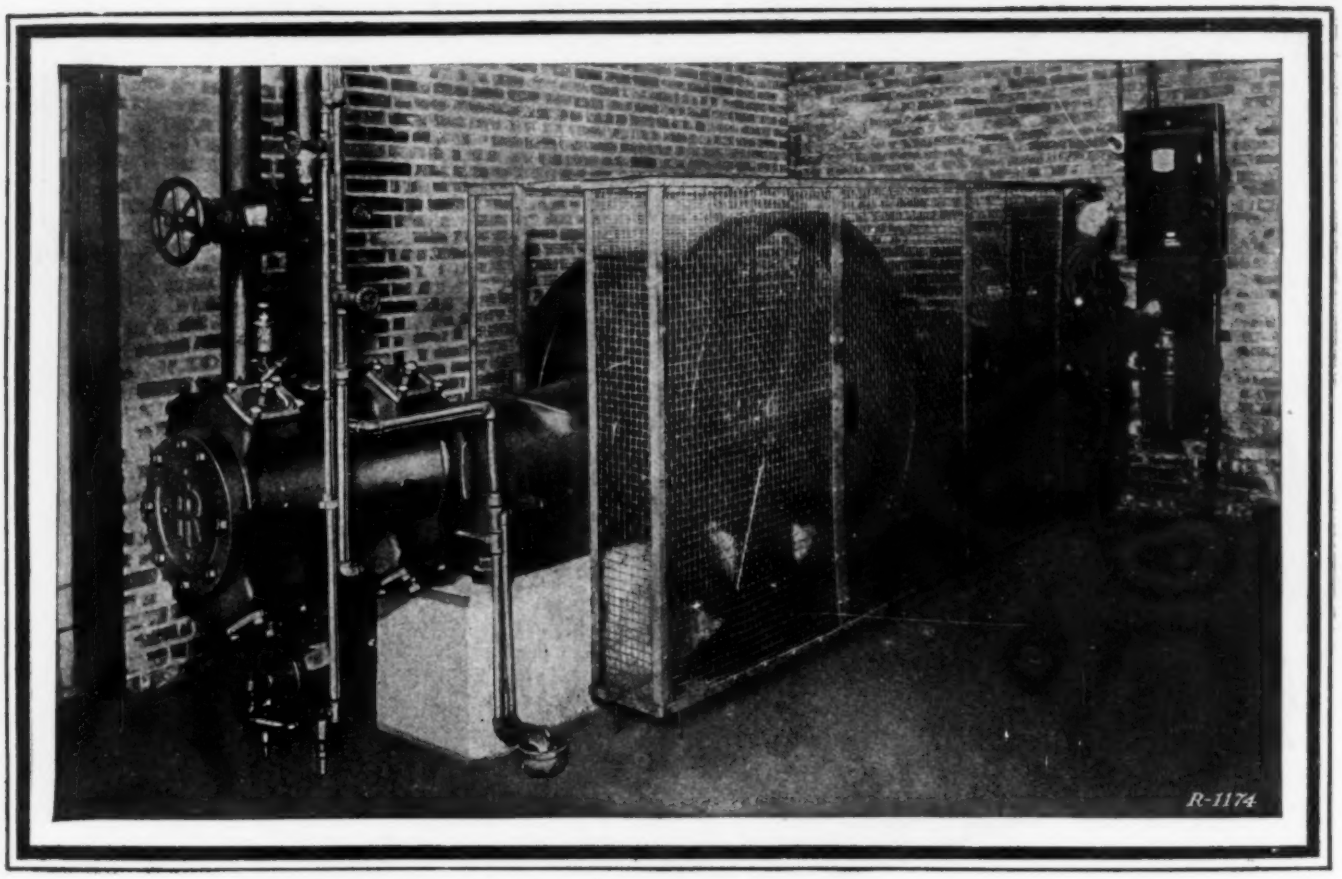
1. Pressure castings—
2. Leaded bronze bearings—
3. Valve bronzes—
4. White metals—
5. Aluminum alloys—

and are thereby obtaining:

1. Better and finer structure—
2. Prevention of lead segregation—
3. Pressure tightness—
4. Increased hardness and strength—
5. Increased ductility and toughness—
6. Attractive color—
7. Corrosion-resistance.

INCO NICKEL **Nickel** INCO NICKEL

THE INTERNATIONAL NICKEL COMPANY (INC.), 67 WALL STREET, NEW YORK CITY



The I-R line of Pneumatic Tools is complete, including sand rammers, chipping and scaling hammers, core breakers, grinders, and hoists.

Foundry production depends on the efficiency of one machine

From molding floor to cleaning room, compressed air is the key to efficient operation in the foundry. Insufficient pressure in the air line means inefficient tools and equipment throughout the shop.

Ingersoll-Rand Compressors have built for themselves a reputation for continuous, satisfactory, money-making operation. Their continued efficiency is assured by the close cooperation of a willing, trained service organization. Proven equipment and real service—that is what the name Ingersoll-Rand on an Air Compressor means to the foundryman.

Write for catalogues or service of any kind—we will gladly cooperate in every possible way.

INGERSOLL-RAND COMPANY—11 BROADWAY, NEW YORK CITY
Offices in principal cities the world over
FOR CANADA REFER—CANADIAN INGERSOLL-RAND CO., LIMITED
10 PHILLIPS SQUARE, MONTREAL, QUEBEC

861-C

Ingersoll-Rand

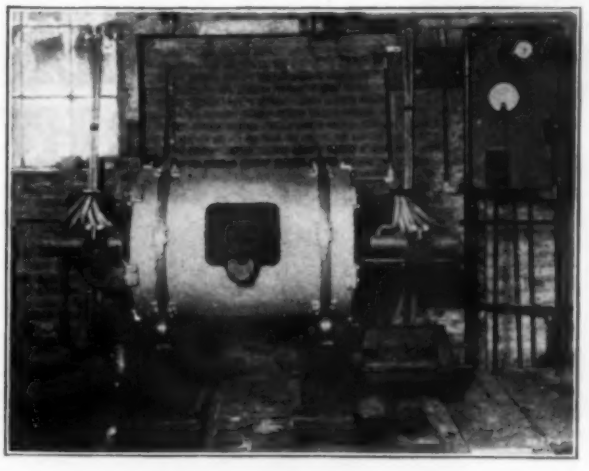
PROFITS

That's really what you're after in your foundry business,—*PROFITS!* With that idea in mind, if we can definitely show you a thirty to fifty percent reduction in melting cost together with a material increase in the percentage of good castings shipped, with lowered cost of supervision, inspection and operation, isn't that sufficient justification of a healthy interest in the use of

Detroit Electric Furnaces

"Ask the Man Who Uses One"

Quality Under Definite Control at all times



Costs Materially Lower than By other Methods

Detroit Electric Furnace Co.

Detroit, Mich. **San Francisco, Cal.**

Motors on Timkens

The most vital specification you can make on any order for electric motors is "Timken Bearings." That specifies not alone the lubricating economy of anti-friction bearings, but the supreme endurance made possible only by Timken tapered construction, Timken *POSITIVELY ALIGNED ROLLS*, and Timken-made electric steel.

In this exclusive Timken combination there is high speed capacity, extra load area, full thrust and shock capacity, greater rigidity, compactness, and simplicity.

Forget burnouts and shutdowns entirely! Get rid of dripping and fire hazards. Wipe out all the cost of bearing replacement, and almost all routine maintenance. Improve every phase of operation.

Specify Timken Tapered Roller Bearings in all the motors you buy.

THE TIMKEN ROLLER BEARING CO.
C A N T O N , O H I O

TIMKEN *Tapered Roller* **BEARINGS**

DOUBLE ROW SELF-CONTAINED TIMKEN BEARING

SINGLE ROW TIMKEN BEARING

The Fire Clay

that is

INHERENTLY
DIFFERENT

BONDING OR REBONDING
MOLDING SANDS
PATCHING-OR
LADLE & SPOUT LININGS
CONVERTER LINING
LAYING UP BRICK *and*
THE MANY OTHER REFRACTORY
NEEDS OF THE IRON *and* STEEL
INDUSTRY

Tests and Results PROVE IT

NUMEROUS Iron and Steel Plants are using Goose Lake Fire Clay for general refractory purposes and a majority of the Foundries that are rebonding their sand have standardized on Goose Lake Fire Clay Flour for this purpose.

This practice of rebonding molding sand with Fire Clay Flour was originally intended to reclaim used sand, but has since proved to be of even greater value in the production of smoother castings, with noticeable economy in cleaning costs and a reduction in the losses due to sand defects.

Progressive foundries with most experience in rebonding sand or in the use of a manufactured sand have found that very few of the plastic fire clays, in ordinary use, are at all suitable for this purpose. Research shows a great difference in results that are quickly verified by service tests in the foundry. The economies obtained from bonding or rebonding are most attractive, but only a properly prepared, highly refractory material of great bonding strength and durability is suitable for this purpose.

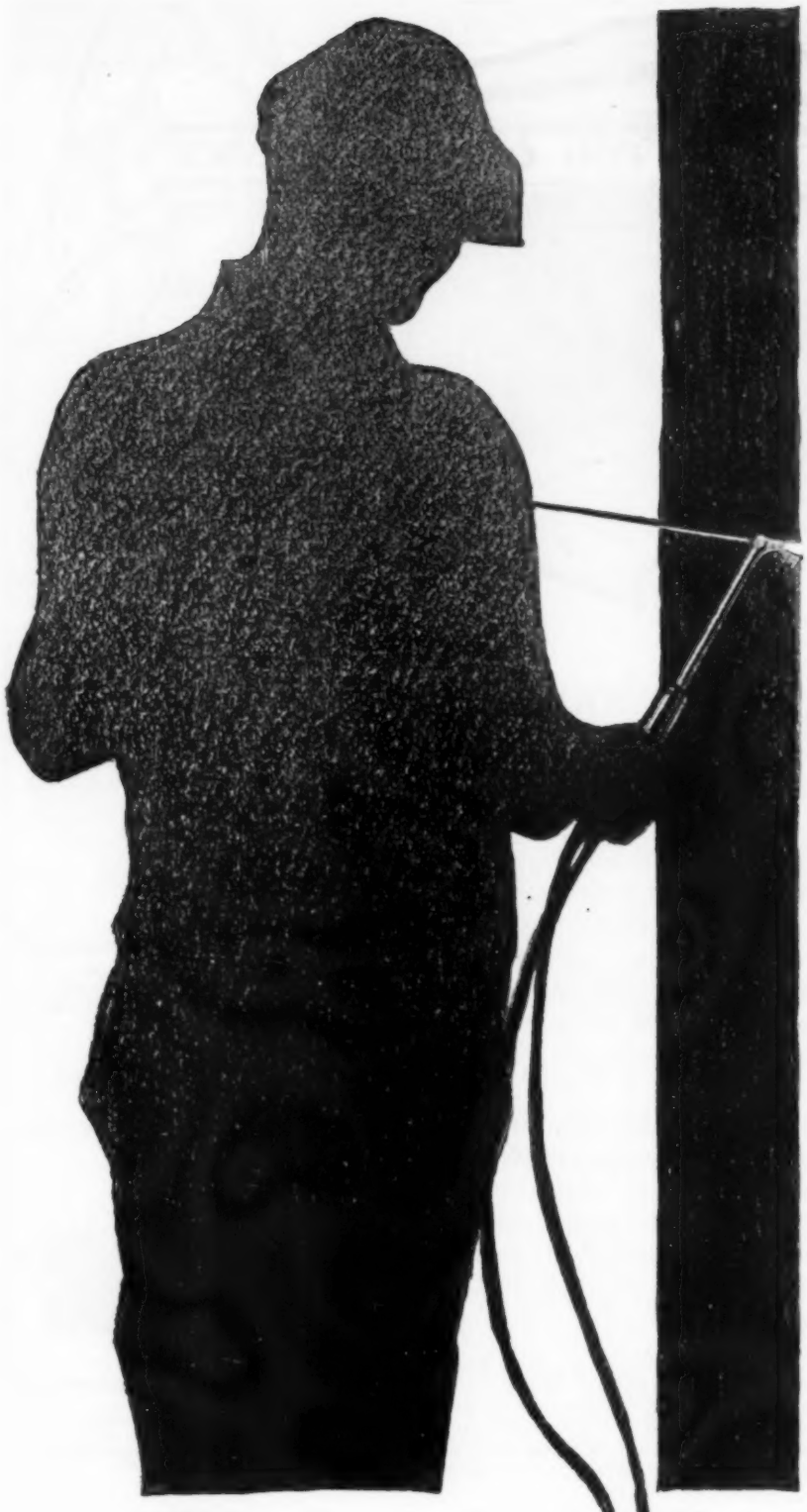
Our Goose Lake Fire Clay deposit is truly different from other fire clays in geological location and nature of the clay veins. Many of its ceramic properties are unusual and of great value. The clay structure is remarkably uniform and of a distinctly different mineralogic composition as proved by microscopic and petrographic examinations. When highly magnified Goose Lake Fire Clay shows a dense, fine grained, uniform structure like a section of high grade steel, while many other fire clays show large quartz grains and nodules of pyrites or in some instances as high as 35% impurities in the clay body, all of which are highly objectionable.

Facts such as these about the quality and standing of Goose Lake Fire Clay are attracting users of other fire clays. Consult our Engineering Service about the advantages of Goose Lake for rebonding your molding sands and as a general refractory. Sample and quotation on request.

Illinois Clay Products Co., Joliet, Illinois

GOOSE LAKE
Fire Clay and Fire Clay Flour

Illinois Clay Products Company
JOLIET ILLINOIS

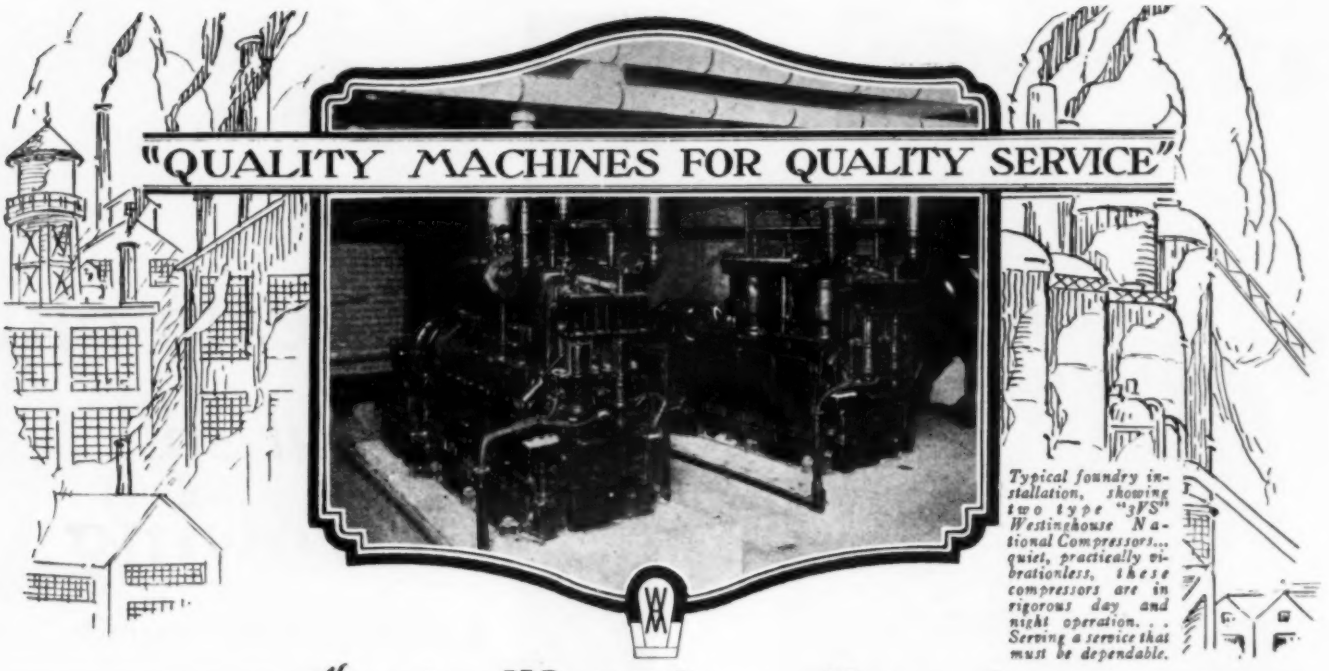


22 years old *but still* Growing

Large volume usually indicates a good product. Certainly this is true of Prest-O-Lite dissolved acetylene which has been used in greater volume year after year for 22 years. Today you can obtain Prest-O-Lite for oxy-acetylene welding and cutting from 119 plants and warehouses.

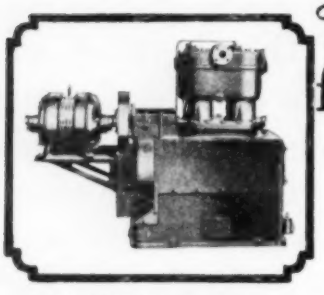
The PREST-O-LITE COMPANY, Inc.
Unit of Union Carbide and Carbon Company
General Offices: Carbide and Carbon Building
30 East 42d St., New York
31 Plants—101 Warehouses

Prest-O-Lite
DISSOLVED ACETYLENE

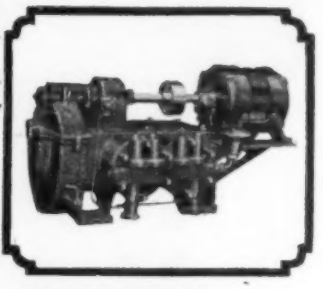


Typical foundry installation, showing two type "3VS" Westinghouse National Compressors... quiet, practically vibrationless, these compressors are in rigorous day and night operation... Serving a service that must be dependable.

There is a Westinghouse National for *every* pneumatic requirement



Type "2V" compressor . . . 75 to 150 cu. ft. displacement is fully described in publication T-2047.

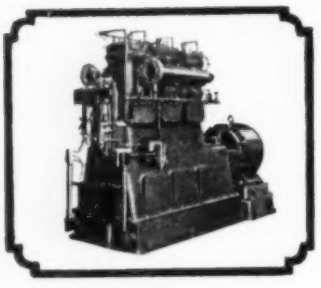


Type "N" compressor . . . 12 to 60 cu. ft. displacement is fully described in publication T-2048.

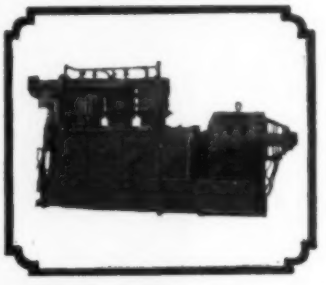
BUILT in capacity sizes, ranging from 3 to 700 cu. ft. displacement, all Westinghouse National Air Compressors are designed and sturdily constructed to render a thoroughly dependable service. Infinite care and precision throughout their manufacture has given them unique recognition as the "Quality Machines For Quality Service."

Traditionally dependable, they run quietly, take up minimum valuable floor space, operate economically, and demonstrate conclusively, throughout years of faithful service, their superiority in maintaining maximum pressure for all shop and foundry requirements.

Detailed information, relative to the installation of a dependable pneumatic source, may be had by writing the Westinghouse Company, or from any of our conveniently located field offices . . . This service is maintained exclusively for the use of those interested in Quality pneumatic systems and is in no way obligatory.



Type "3VD" compressor . . . 550 to 700 cu. ft. displacement is fully described in publication T-2032.



Type "3VS" compressor . . . 208 to 468 cu. ft. displacement is fully described in publication T-2032.

Westinghouse Traction Brake Co.

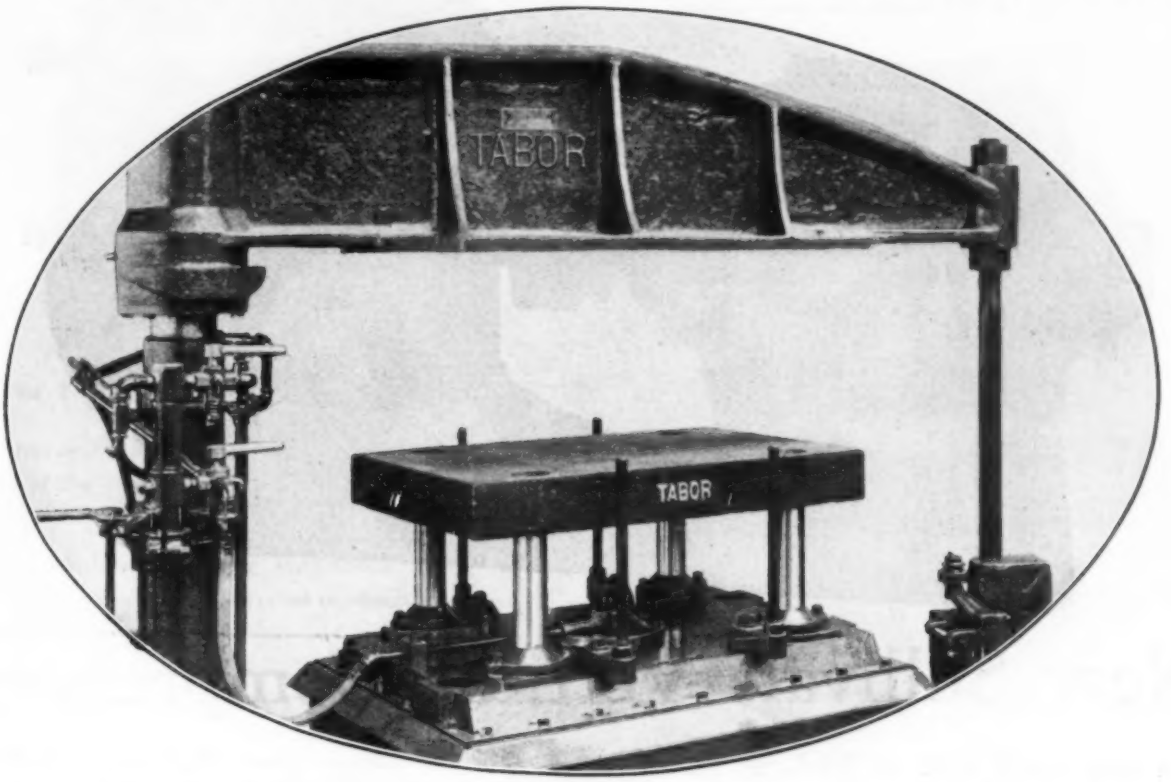
Industrial Division

General Office *and* Works···Wilmerding, Penna.

9021

WESTINGHOUSE—NATIONAL *Air Compressors*

A JAR STRIP SQUEEZE MACHINE WITH AN ADJUSTABLE HEAD



No further need to make your machine fit the flask size ---or vice versa. Fit the flask to the job, and "go to it"---If you have a TABOR the machine will fit the flask.

The Tabor Principle makes possible the use of an *Adjustable Head* on any machine of this type, from the smallest to the largest. This adjustability permits the use of any sized pattern plate and flask within the capacity of the machine. . . . . .

AND IN ADDITION to these advantages, you obtain the increased speed---the longer life---the lower production cost --- the permanent accuracy of the Tabor Flask Lift type machine. . . . . .

THE TABOR MANUFACTURING COMPANY
6225 TACONY STREET : PHILADELPHIA : PENNA.

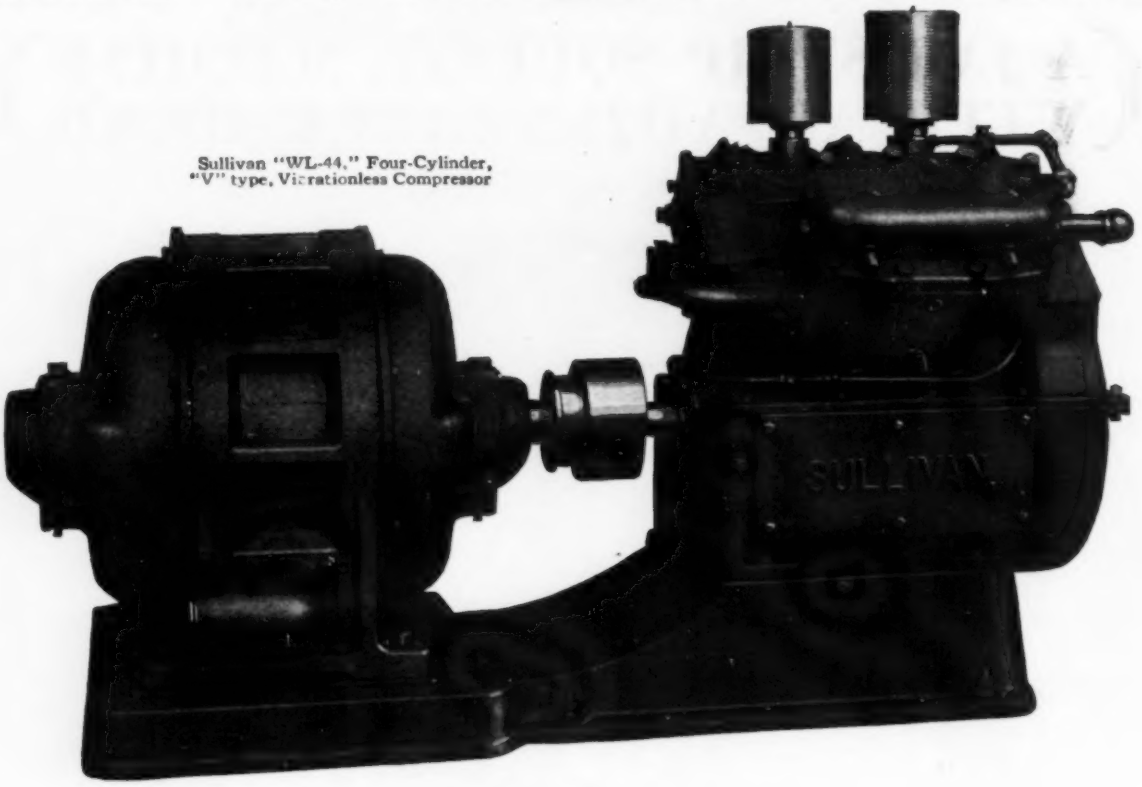
Western Representatives:

Northern California: PACIFIC GRAPHITE WORKS, Oakland, Cal. *Southern California:* SNYDER FOUNDRY SUPPLY CO., Los Angeles, Cal.

Foreign Representatives:

Great Britain and Ireland: MACNAB & CO., 56 Eagle St., Southampton Row, London, Eng. *Japan:* MITSUI & CO., Tokio, Japan
European Continent: F. G. KRETSCHMER CO., Frankfort, A. M., Germany
Australian Agent: BENSON BROS., LTD., Sydney, Australia

DEPEND ON SULLIVAN AIR POWER



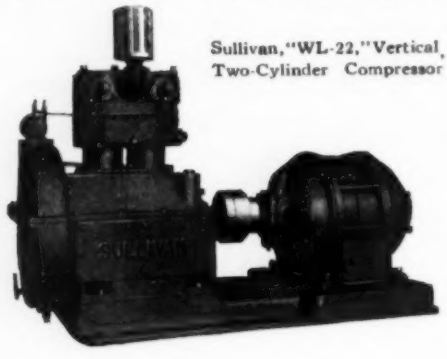
Sullivan "WL-44," Four-Cylinder, "V" type, Vibrationless Compressor

New Sullivan Vertical Compressors

Do you need 100 to 240 cu. ft. of air per minute—plus

Small floor space?
Easy portability?
Direct motor drive?
Automatic or hand control?

These advantages are offered by the new Sullivan "WL-22" two-cylinder, and "WL-44" four-cylinder vertical type compressors shown here.



Sullivan, "WL-22," Vertical, Two-Cylinder Compressor

For the shop or power plant that is short of floor space—for isolated departments in large plants—for standby or night service—or for the contractor desiring a semi-portable air unit, these compressors will be most attractive.

These new compressors are direct driven by electric motors, and both compressor and motor are mounted rigidly on a one-piece cast iron base.

Note These Valuable Features

Special features of these machines are "Wafer" inlet and discharge valves, sweep control unloading device, positive automatic lubrication and full water cooling of cylinder barrels and heads. They are adapted to push button, automatic, or combination push button and automatic start and stop control.

"WL-22" occupies a floor space of 6 x 2½ ft.; "WL-44," 6 x 3 ft.

You will want to know more about these balanced "Vibrationless" compressors.

Write for Catalog 1883-H

SULLIVAN

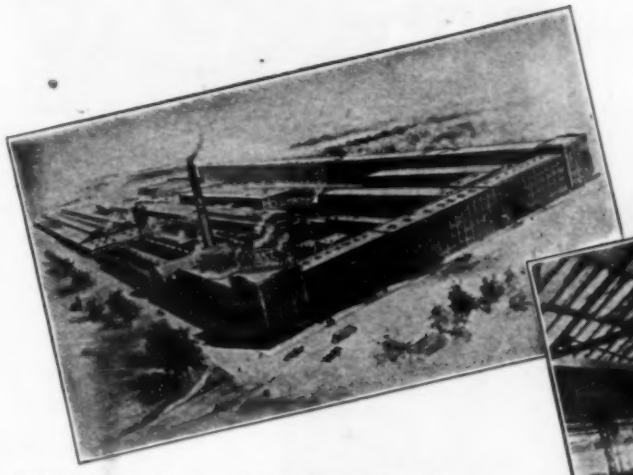
Boston, New York, Cleveland, Pittsburgh, St. Louis, Knoxville, Birmingham

SULLIVAN MACHINERY COMPANY

146 SOUTH MICHIGAN AVE., CHICAGO

Dallas, Duluth, Denver, Spokane, El Paso, San Francisco, Salt Lake City

Moline Molding Machines



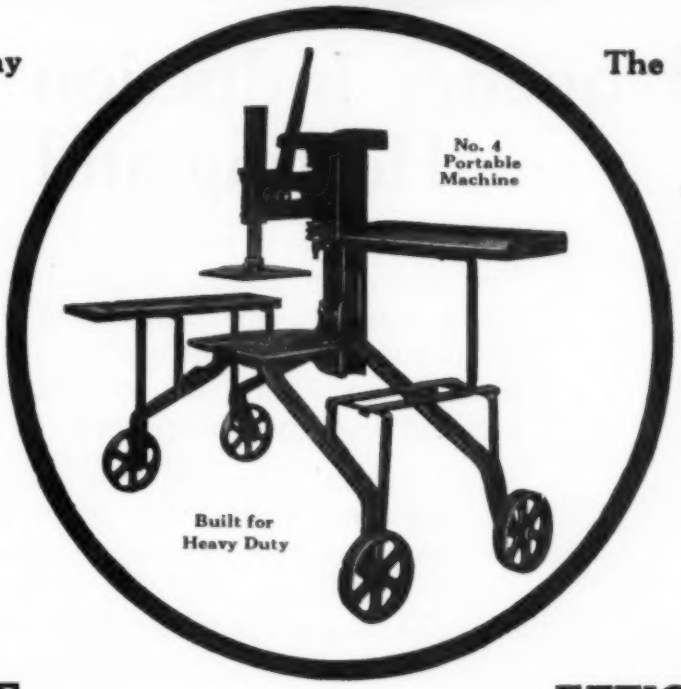
The Yale & Towne Manufacturing Co.
Stamford, Conn.
(largest makers of locks in the world)

Have one of the largest and best equipped foundries in the country and are using an increasingly large battery of

Moline Molding Machines

To reduce costs and increase production.

Moline Squeezers Pay for Themselves Soon After Installation.



The Machine Illustrated is one of four types which we manufacture.

NO. 1 STATIONARY

NO. 2 PORTABLE
(Side of pile type)

NO. 3 PORTABLE
(Straddle Type)

NO. 4 PORTABLE
(Heavy duty - Straddle type)

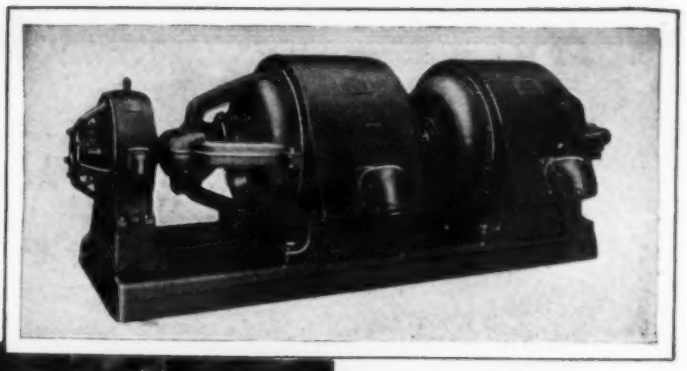
SIMPLE EFFICIENT RELIABLE

Write today for complete descriptive catalogue.

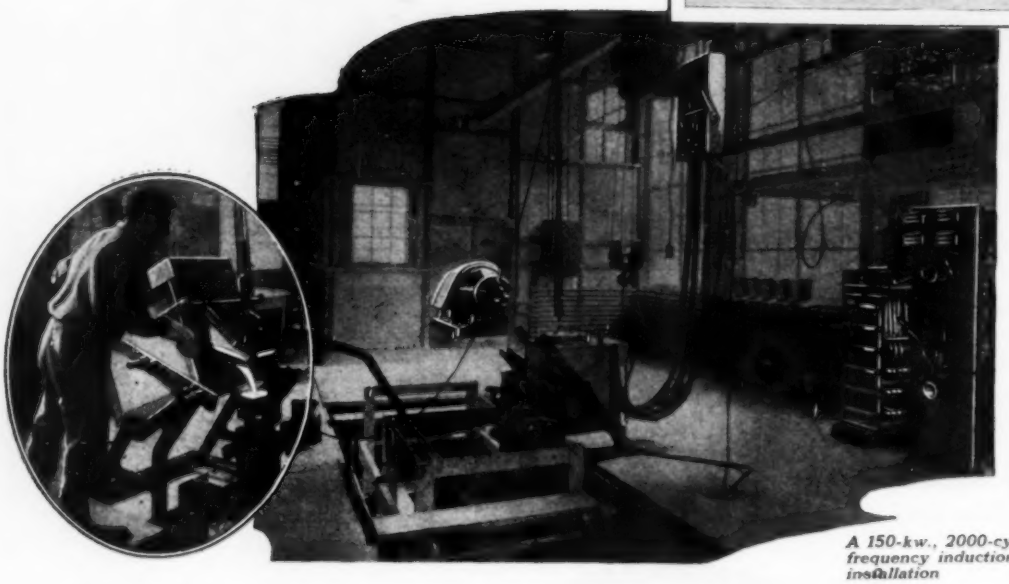
"All The Working Parts Are Above the Table and Flask"

Think What This Means!

Moline Iron Works
Moline, Illinois
U. S. A.



150-kw., 2000-cycle motor-generator



A 150-kw., 2000-cycle high-frequency induction-furnace installation

High Frequency Induction Heating and Melting

The heating and melting of metals by high-frequency induction currents has come forward rapidly. So remarkable have been the results achieved that leading industrial executives everywhere are investigating both the method and the equipment.

The General Electric Company, working in co-operation with the Ajax Electrothermic Corporation, has developed the electric equipment necessary for the process—consisting of high-frequency generating equipment, control equipment, and capacitors.

General Electric in co-operation with the Ajax Electrothermic Corporation will gladly assist prospective users of this process to obtain equipment best fitted to their requirements.

General Electric manufactures a complete line of electric accessories for all types and sizes of electric furnaces. Included in this list are:—Transformers, reactors, capacitors, switchboards, automatic electrode regulators, motors, special furnace cables, and all the necessary generating apparatus.

560-1

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

The Branford Vibrator Core Shakeout

The Branford Beacon Discloses

This illustration shows a 5″ "Branford" Core Shakeout Vibrator in place for shaking out cores from a boiler section casting.

The core was removed from this 48 inch square heater section in seven minutes. This formerly took one and one half hours to clean by hand.

Why spend as much time cleaning cores from boiler sections, steam domes, manifolds, and fire pots, as you do in molding them? The average foundry will make major investments in molding equipment and let the cleaning room eat up the saving in cleaning their castings.

Made in sizes from 2″ to 8″ piston diameters.

Send for questionnaire—fill in specifications—we will quote.

Distributors

Buckeye Products Co., Cincinnati; Carpenter Bros., Milwaukee, Wis.; Combined Sup. & Equip. Co., Buffalo, N. Y.; Canadian Foundry Supplies and Equipment Ltd., Montreal, Que., Canada; Toronto, Ont., Canada; Donald Sales & Mfg. Co., Milwaukee, Wis.; Federal Foundry Supply Co., Milwaukee, Wis.; Freeman Supply Co., Toledo, Ohio; Hill & Griffith Co., Chicago, Cincinnati, Birmingham, Ala.; W. Scott Thomas, 316 National Exchange Bank Bldg., Providence, R. I.; J. S. McCormick Co., Pittsburgh, Pa.; Mineral Supply Co., Chicago, Ill.; Moline Sales Co., Moline, Ill.; N. Y. Sand & Facing Co., Brooklyn, N. Y.; Nixon-Hasselle Co., Chattanooga, Tenn.; S. Obermayer Co., Chicago and branches; Paxson-Taggart, Inc., Phila., Pa. Providence R. I.; Rochester-Osborn Co., Rochester, N. Y.; J. J. Shannon, & Co., Phila. Pa.; Snow & Galgiani, San Francisco, Calif.; Snyder Fdy Supply Co., 2434 E. 57th St., Los Angeles, Calif.; F. B. Stevens, Detroit and branches; R. J. Teetor Co. Muskegon, Mich.; Whitehead Bros. Co. Buffalo, New York, Providence, R. I.; E. J. Woodison, Detroit and branches.

MALLEABLE IRON FITTINGS CO.

BRANFORD, CONN. U. S. A.

Simplifying the Christmas Problem

MORE and more the intelligent public turns to books to settle the ever-perplexing problem of "what to give for Christmas".

And if books, why not select those that are useful and practical pertaining directly to the kind of work your friends are interested in. Books that will help to increase their knowledge and earnings—a gift that will be used and appreciated for years.

A few suggestions—

BARTON—Refining Metals Electrically **$6.00**

Deals essentially with the foundry angle of electric furnace-practice. It is comprehensive, thorough, up-to-date and is written for operators, managers, and executives of electrically equipped foundries, from the standpoint of the practical man. The subject is presented in such a way that those unacquainted with electric furnace practice may study it and familiarize themselves with the points they should know if the installation of electrical units is contemplated.

FOUNDRYMEN'S HANDBOOK **$5.00**

A compilation of the Data Sheets which have been published in THE FOUNDRY for many years and is a digest of rules, formulas and tables of constant use in modern foundry operations. It contains practical information that is essential to the foundryman, pattern-maker, metallurgist and student much of which never has been printed elsewhere. The book is arranged and cross indexed in such a way that subjects easily are found.

VICKERS—Metals and Their Alloys **$7.50**

This complete and exhaustive treatise deals with practically all known modern nonferrous metals and their alloys. It is enriched by the wealth of experience of Charles Vickers, for many years a practical foundryman, consulting expert on brass foundry practice and nonferrous editor of THE FOUNDRY.

A B C of Iron and Steel **$6.00**

This book describes accurately and completely, but in a simple, interesting, and nontechnical way, every step in the manufacture of iron and steel from the ore to the finished product.

BELT—Foundry Cost Accounting **$6.00**

Devoted exclusively to problems of cost accounting in the foundry. A practical method is given for cost finding which can be installed and maintained without the aid of experts. The principles and forms may be adapted to fit the requirements of any foundry, large or small—gray iron, steel malleable, or nonferrous.

TAFEL—Theory and Practice of Rolling Steel **$6.00**

Covers every angle of the design, construction and operation of the steel rolling mill. Discusses every phase and problem of rolling mill and roll design from blooming mill to the most intricate shapes.

HALL—The Steel Foundry **$4.00**

Covers the metallurgy and production of all classes of steel castings. It gives the details of the various steel making processes and shows the relative cost of installation and quality of steel produced, covers all phases of foundry procedure such as molding, pouring, annealing, etc.

MOLDENKE—Principles of Iron Founding **$5.00**

A comprehensive treatise on the basic principles underlying the best modern foundry practice. The book goes into the vital elements of iron-making and its allied industries with the object of drawing definite conclusions therefrom of real value to the foundryman in his daily work.

PALMER—Foundry Practice **$3.00**

A book of great value to the practical foundryman, molder, student and apprentice. The subject-matter follows a scheme of instruction beginning with the simplest type of molds, leading gradually through the more difficult lines of work.

Prices include delivery postpaid anywhere in North America.
For other countries add 25c for each book.

THE PENTON PUBLISHING CO.
Penton Bldg., Lakeside Ave. & W. 3rd St.
Cleveland, Ohio

Date.....

Enclosed is $..... for which you are to send the following books to the addresses indicated. You are to ship them so that they will be delivered a day or two before Christmas, and enclose with each a Christmas card showing that the gift is from me.

My Name and Address.....

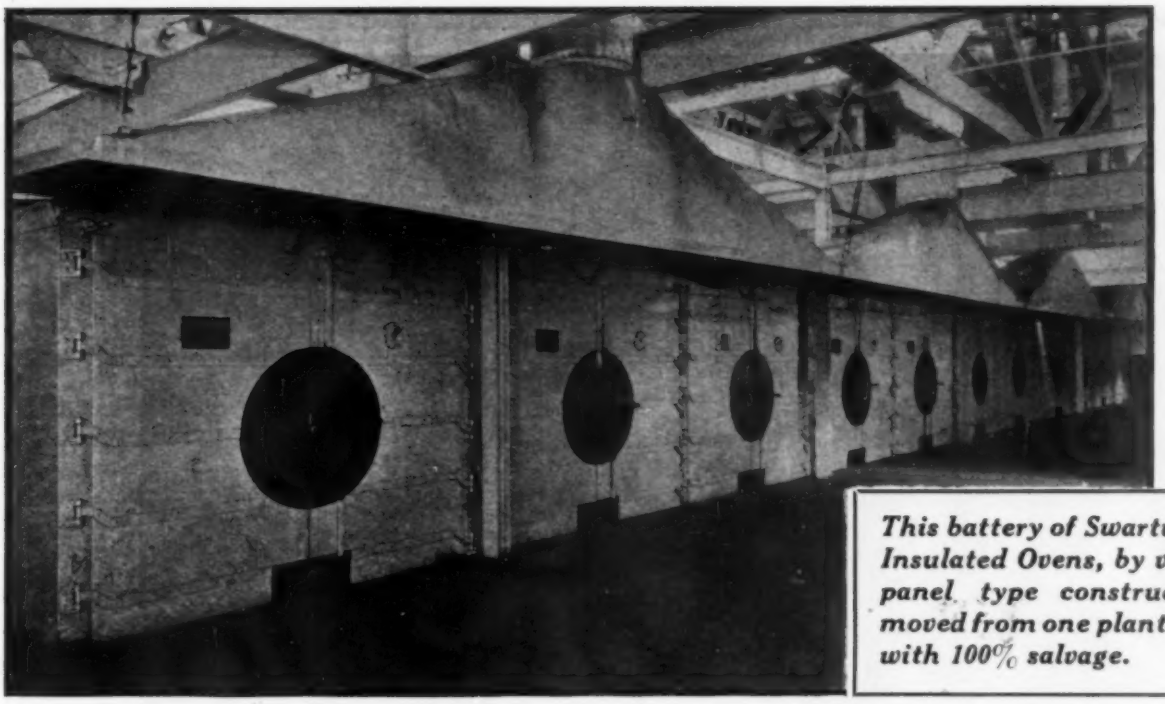
Send.....to.....

.....

Send.....to.....

.....

143 IF



This battery of Swartwout Metal Insulated Ovens, by virtue of its panel type construction, was moved from one plant to another with 100% salvage.

When Moving-Day Came—

they took their ovens along

IT was imperative that a large manufacturer transfer operations from one state to another. Only a certain amount of equipment could be disassembled and transported economically. The battery of Swartwout core ovens pictured above *went along*.

By a new and exclusive panel type construction, Swartwout has made such unusual performance possible—and with 100% salvage of the ovens.

Plant layout can now be changed—or cross country moving undertaken if necessary—without incurring loss of your Swartwout Metal Insulated Ovens. They come down easily, are transported without trouble and can be re-erected rapidly. And this is only *one* point of superiority that Swartwout Metal Ovens show over the brick oven.

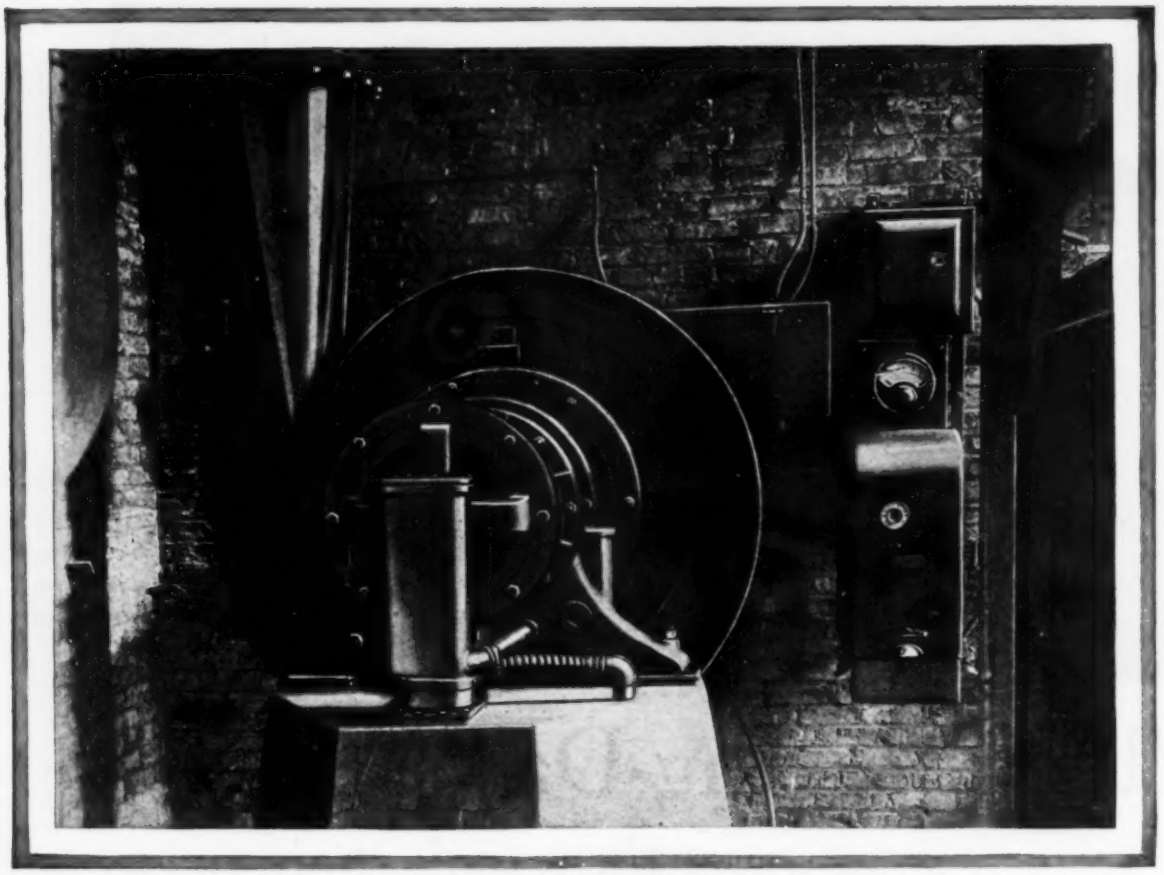
Swartwout can supply an oven for every baking need. If your work cannot be handled in a standard type, Swartwout engineers will design an oven that *will* do the job.

The Swartwout Company

Executive Offices: 18531 Euclid Avenue, Cleveland
Factories at Cleveland and Orrville, Ohio

Swartwout

Metal Insulated Ovens



G-E Centrifugal Cupola Blower in the Foundry of Greenlee Bros. Co., Rockford, Ill.

Are You Satisfied with Your Iron?

If you want consistently high-grade iron, install G-E Centrifugal Cupola Blowers. Associated with G-E Blowers are characteristics which indelibly stamp them wherever they are installed:

> They require less power to operate; they cost less to maintain; they make possible higher quality and greater quantity of iron from the cupolas.

Continued repeat orders attest to the sincerity of these claims.

No matter how accurately your cupola mixtures may be specified, you cannot secure satisfactory results unless you employ accuracy in admitting the air. When G-E Blowers are used you can control the air supply by varying the opening of the blast gate. A double scale ammeter, calibrated in cubic feet per minute, can be supplied to show the volume flowing to the cupola.

Write to your nearest G-E office for information and service.

G-E Blowers represent:

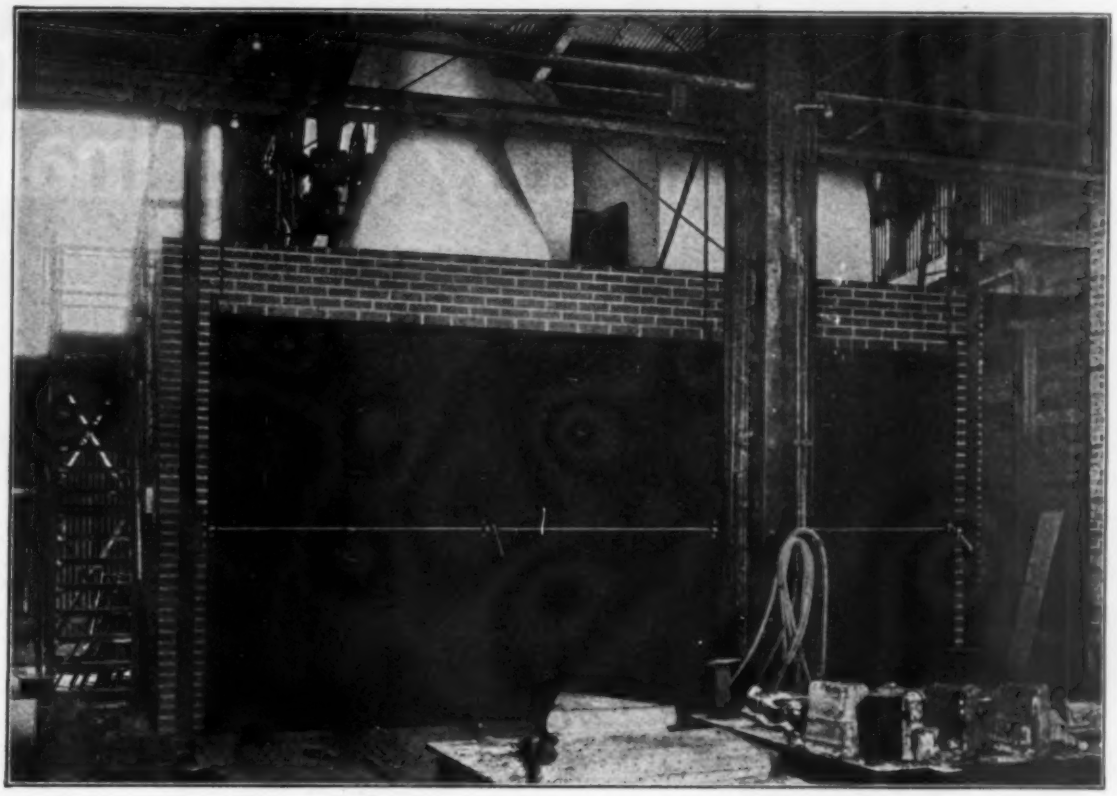
- In volumes and pressures—the most complete line manufactured.
- In quality—the best in design, materials, and workmanship.
- In performance—absolute reliability.
- In operating costs—the most economical known.

321-4

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

Another Satisfied User



McCann-Harrison Direct Oil Fired Air Heaters and Core Baking System recently installed in a prominent foundry.

McCann-Harrison Core Baking systems reduce Core Baking Costs to a minimum, because of:

1. The efficient Direct Oil Fired Air Heaters.
2. The Induced Draft system which produces a uniform temperature in every part of the Oven.—No Rejects.
3. The elimination of costly and heat-consuming underground flues and combustion chambers.
4. The recirculation of hot gases.
5. The automatic temperature control.

McCann-Harrison Core Baking Systems include: Batch or Conveyor type Ovens, Vertical or Horizontal.

Send for Bulletins.

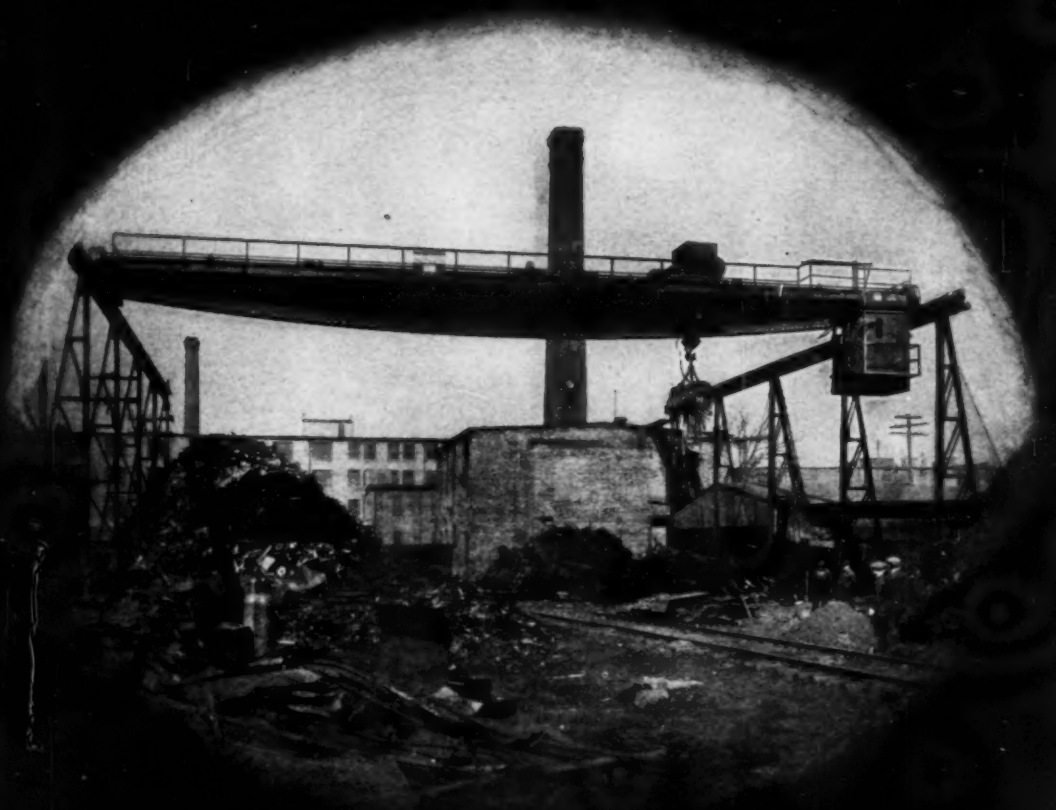
McCann-Harrison Corporation

AIR HEATERS, FURNACES, OVENS, DRYERS

General Offices—Cleveland, Ohio

NEW YORK DETROIT CHIC AGO

There are more P&H Electric Traveling Cranes in Service than any other make



FOR more than 35 years, P & H Cranes have been serving industry. Today there are more than 8500 in operation (more than any other make) and the first ones built are still in service.

Users who buy cranes only after careful investigation are among our best customers, among these being most of the large industrial firms in the United States. Many of these companies have from 10 to 270 P & H Cranes each. These repeat orders are the most convincing proof of P & H Quality and Service.

HARNISCHFEGER CORPORATION

Established in 1884

3804 National Avenue, Milwaukee, Wis.

New York *Chicago* *Charlotte* *Pittsburgh* *Los Angeles* *Atlanta*
Philadelphia *Kansas City* *Detroit* *Portland* *Seattle* *St. Louis*
Birmingham *San Francisco* *Dallas* *Memphis* *Jacksonville* *Boston*
Indianapolis *Baltimore* *Minneapolis*

WAREHOUSES AND SERVICE STATIONS

Philadelphia, Memphis, Jacksonville, San Francisco, Los Angeles, Seattle

P&H

YOUR BATTLE LINE *is in the Shop!*

A prominent automobile manufacturer safeguards profits in the face of increasing competition with the aid of this Mathews Conveyer System.

URGE your sales force on under high pressure if you choose . . . base every business move on the soundest principles—but remember that your real "battle line" is drawn up *in the shop* where operating expenses decide the final issue.

Conveying equipment plays a leading role in today's production plans and Mathews Conveyer Systems, designed for continuous foundry operation as well as speeding up production in the machining and other departments, are eliminating shop delay and lowering costs.

Orders secured in an exacting market must be filled on schedule and within a price limit. A Mathews Conveyer System will go far in helping you to "make the grade."

MATHEWS CONVEYER COMPANY, Ellwood City, Pa.

Atlanta, Birmingham, Boston, Buffalo, Chicago, Cleveland, Dallas, Dayton, Denver, Detroit, Houston, Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, St. Louis, Salt Lake City, San Francisco, Seattle. Mathews Conveyer Company, Ltd., Port Hope, Ont.

MATHEWS
Conveyer Systems
Increase Plant Profits

MATHEWS CONVEYER COMPANY
104 Tenth Street, Ellwood City, Pa.

Perhaps we do need a Mathews Conveyer System. Send ☐ the Mathews Foundry Book; ☐ the Mathews Engineer.

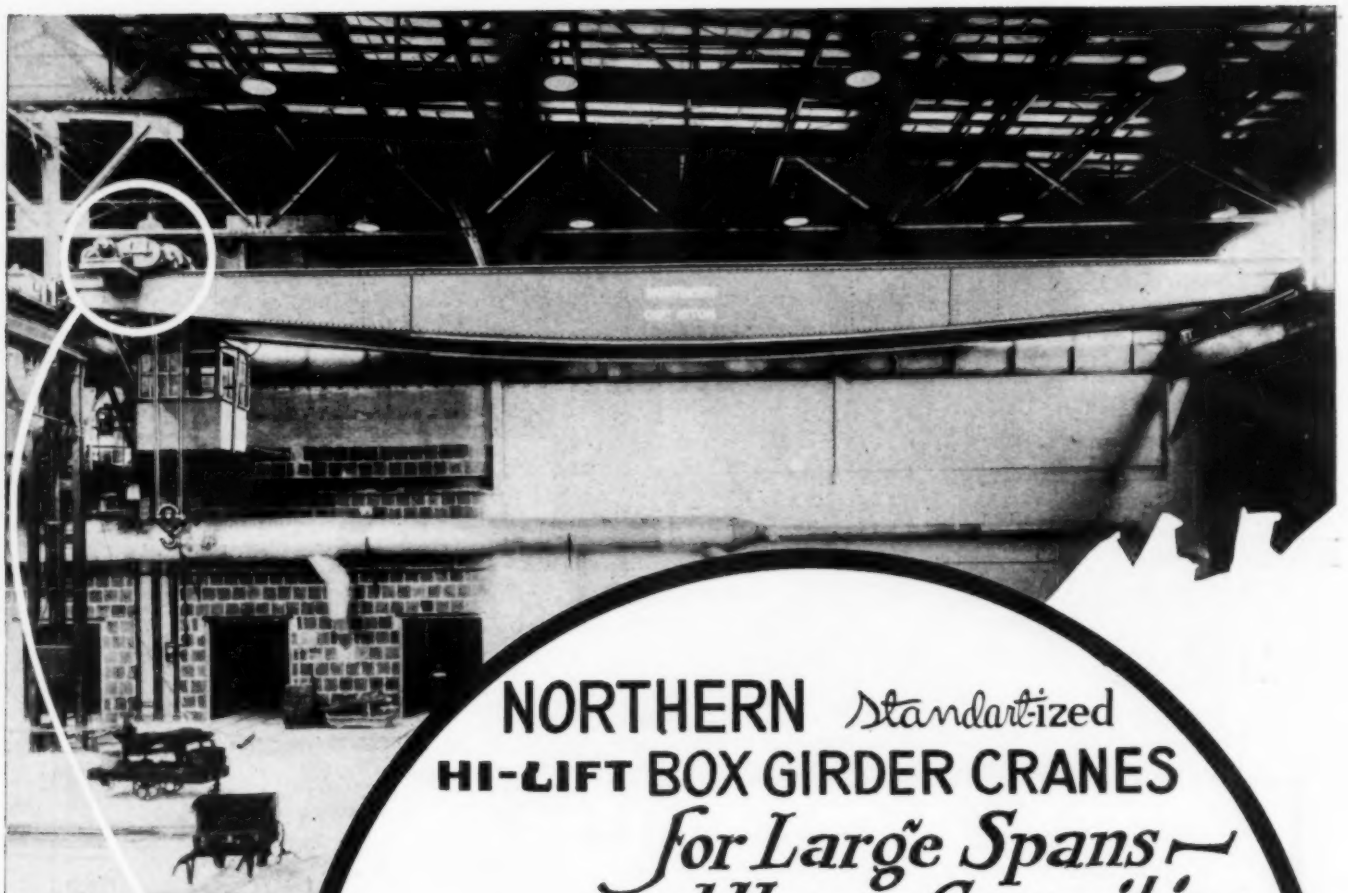
Signed.....

Firm.....

Address.....

City..... State.....

Fo 12-15-27



NORTHERN *Standardized* HI-LIFT BOX GIRDER CRANES *for Large Spans and Heavy Capacities*

The load hook has a greater length of travel in all directions—up, down, east, west, north and south. The greatest floor area and building volume come within range of the load hook. These are important points to consider when installing a crane in an old building as well as in a new one. Space and area covered represent savings in building construction and savings in material handling costs.

It will pay you to have information on what this specialized type of crane has done in other plants and what it can do for you—yours for the asking.

NORTHERN ENGINEERING WORKS

DETROIT MICH., U.S.A.

2605 ATWATER STREET.

Branch offices in all principal cities. 31-D

Surface color on any casting can be matched *perfectly* with SMOOTH-ON NO. 4

Smooth-On surface without special finish. Matches most castings.

Smooth-On surface lightened by rubbing with graphite.

Smooth-On surface further lightened by rubbing with dry Smooth-On powder.

A SMOOTH-ON filling cannot be detected by color or otherwise.

A plain Smooth-On filling matches most cast iron surfaces in color, but if it does not, on account of the shade of graphite used in the molds, a simple treatment can be utilized to make the two surfaces identical.

After the Smooth-On has been placed and only partially hardened, rub some graphite or dry Smooth-On powder over the surface. Just enough will be held by the dampness yet in the patch, to give the desired color shade of the surrounding surface of the solid metal.

If you have had any trouble in getting the right color match, try this little trick and you will be well pleased with the results.

THE SMOOTH-ON HANDBOOK FREE if you return the coupon.

Twentieth Edition—Completely rewritten—136 pages of new data—193 diagrams, pictures and practical hints on at least 200 different uses for SMOOTH-ON. Every progressive engineer should have this book—get your copy NOW.

Smooth-On No. 4 is made in two grades

No. 4A. For castings with *fine* grain.

The very best iron cement for high grade castings that must stand the closest inspection.

No. 4B. For castings with *coarse* grain.

For the general run of castings and far superior to any iron filling obtainable at equal cost.

Get Smooth-On No. 4 from any reliable dealer or supply house in 1-lb. and 5-lb. tins, and 25-lb., 50-lb. and 100-lb. kegs, or if necessary direct from us.

SMOOTH-ON MFG. CO., DEPT. 17,
570 Communipaw Ave., Jersey City, N. J.

Please send copy of the **Smooth-On** Handbook, 20th Edition.

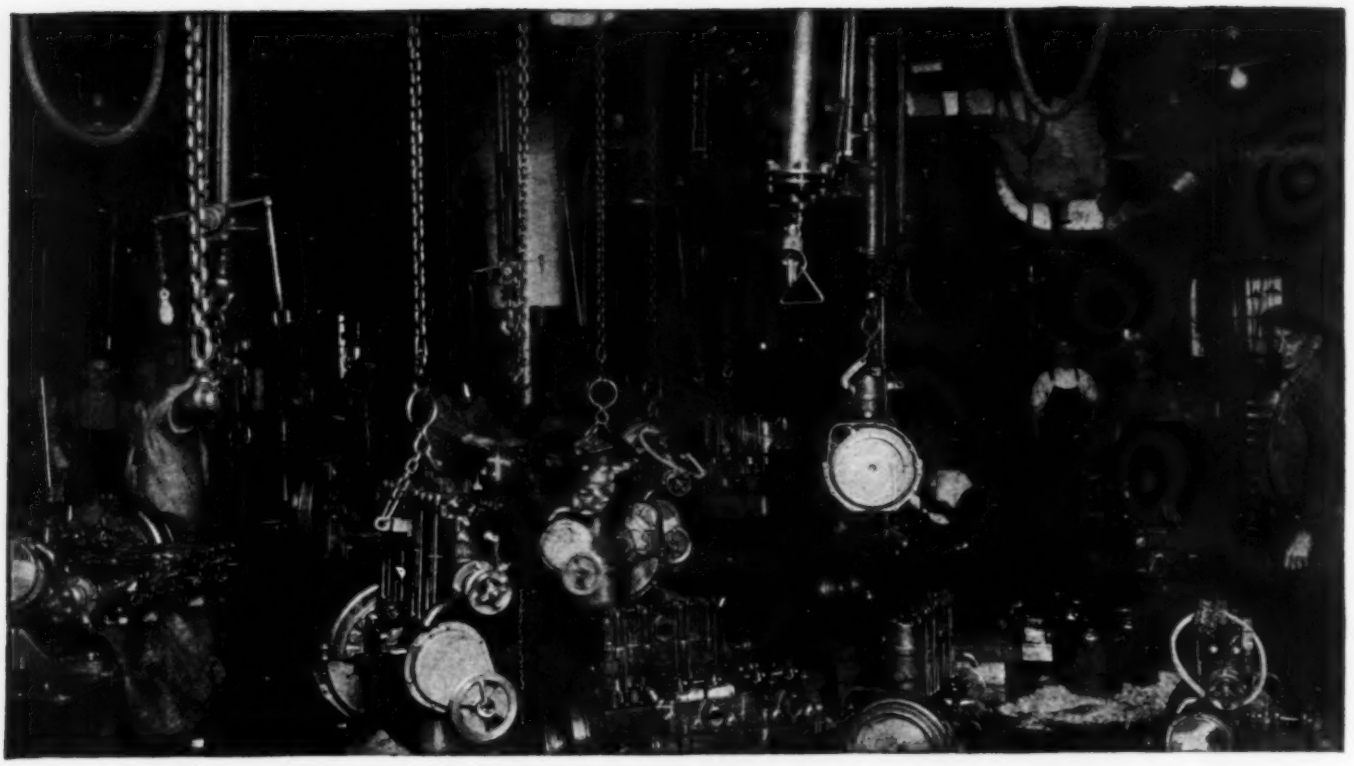
Name.....

Address.....

12-27

Do it with

SMOOTH-ON



Curtis Pneumatic Hoists keep open the "bottle necks" of production in this 2400-a-day automobile plant

In the plant shown above, Curtis hoists are stationed at certain "bottle necks" of production to prevent congestion. Almost any price would have been justified for power hoists that would deliver the speed and dependability required. Yet the Curtis, selected on merit, not price, cost but little more than a totally inadequate hand chain block would have cost!

The Curtis air hoist may have a fixed position, or be mounted on a crane or trolley. It may be used vertically, horizontally or in any other position. It may be direct lift or rope compounded, mounted in an elevated position or buried in the ground.

It fits the greatest imaginable number of local conditions, and is the most generally useful of all types of hoist. May we send further information?

CHECK ITEMS IN WHICH INTERESTED
Model "A" Air Compressors. Full self-oiling. Water cooled.
Air Hoists, Cranes, Trolleys. Fast, economical, speed up production.
Paint Spray Compressor. Hand unloader. (By-pass for starting.)
Style "V" Two-Stage Compressor. Air-Cooled. ¾ to 2 H. P.
Automatic Air Mist Car Wash System. A complete cleaning service.
Hydraulic Car Washer. 1 H. P.; 2 H. P.; 2 H. P. oversize.
Rotating Auto Lift. Oil-locked. Absolute control and safety.
Air Stands. Reel type or tower type. Easy to operate.
Air Lift. For raising one end of car. Excellent for washing underside.
C3

Curtis

Pneumatic Machinery Company

St. Louis

74th Year

1943 Kienlen Ave., St. Louis 518-O Hudson Terminal, New York

THE AMERICAN IRON INDUSTRY—No. 11

With this advertisement we conclude the series featuring The American Iron Industry. The installation illustrated and described below represents the last word in modern foundry practice. The principle of the hot-blast cupola and many other improvements were worked out by Mr. George S. Evans, of The Mathieson Alkali Works, who also developed PURITE.

At left—Rear view of Regenerative Cupola Assembly. Hot-blast stove is shown at left and cupola with skip hoist at right of photograph.

Below—Photograph shows teapot bull ladle, as employed by Griffin Wheel Co., with continuous flow of iron from cupola. This company uses PURITE *for refining all iron melted in this and thirteen other plants.*

PURITE
and the
Hot-Blast Cupola

. . . a combination that controls combustion and impurities

THE quest for better foundry methods is a search that never ends. But every outstanding improvement in methods and equipment is a mile-stone on the road to lower costs. This installation at the Griffin Wheel Co. is the closest approach to the ultimate in melting practice.

With a cupola assembly which includes—

1. Hot-blast stove, utilizing waste gases from the cupola for preheating the blast,
2. Temperature and volume blast controls with recording instruments,
3. Four-burner cupola lighting apparatus,
4. Mechanical charging equipment,
5. Slag trap spout for continuous melting and front slagging,
6. Teapot reservoir mixing ladle,

—with such highly developed equipment combined with PURITE—the Griffin Wheel Company controls combustion, saves fuel, reduces impurities, insures uniformity, and in general, produces better castings at a lower cost.

No single factor is responsible for this result, but it is generally recognized that PURITE plays an important part in effecting these economies and improvements.

PURITE reduces sulphur content, deoxidizes the iron, and washes out occluded gases and entrained slag particles. The use of PURITE represents an established and essential step in the Griffin Wheel Company's practice.

Because you, too, are working toward the ultimate in foundry practice, you will want more information about PURITE. Write us today for literature and technical assistance.

PURITE—an alkali in convenient brick form—is the outcome of experiments with manufactured alkalies for the purpose of further improving foundry practice

The MATHIESON ALKALI WORKS Inc.
250 PARK AVE. NEW YORK CITY

PHILADELPHIA CHICAGO PROVIDENCE CHARLOTTE ST. LOUIS CINCINNATI

Seeing America with The Foundry

Little Journeys to the homes of our readers

NEW JERSEY has a total of 248 Foundries of which

162 Melt Gray Iron
77 Exclusive Non-ferrous
102 Aluminum
67 Non-ferrous Departments of other foundries
4 Melt Steel

NEW JERSEY—"THE GARDEN STATE" has a mild temperate climate, varying considerably between the northern and southern parts of the state. The temperature in the eastern part is modified by sea breezes, which, meeting land breezes, often produce oppressive humidity. The mean temperature at Atlantic City is about 52 degrees, and the annual rainfall is about fifty inches.

This state is second only to Missouri in the production of zinc ore. Minerals of importance are limestone and clays suitable for brick and pottery. Large quantities of rock used for the manufacture of Portland cement are also found and this product is extensively manufactured. Pottery clay is another important mineral product for which New Jersey ranks second among the states. In the southern part large quantities of sand suitable for glass-making is found.

Considering its size, New Jersey is one of the leading manufacturing states; most of its industries are located in the northern section. Those of greatest importance are the manufacture of silk goods, cotton and woolen goods, iron and steel products, machinery, sewing machines, pottery, terra cotta and tile. Considerable jewelry and glass are manufactured. The state's output of silk is about $70,000,000 yearly; one third of the total for the United States.

In NEW JERSEY—THE FOUNDRY has 275 paid subscribers

"Wherever metals are cast you'll find THE FOUNDRY"

Cylinder Blocks!

Now Made More Wear-proof

"Nichrome" B, a nickel-chromium alloy shot, is being used by up-to-date foundries in order to produce a casting that is harder, less brittle, with a grain that is finer, closer and more uniform.

Almost entirely free from hard carbide spots, "Nichromized castings not only offer far greater wear-resisting qualities—but their uniform density allows parts to be machined more readily, minimizing machine shop breakage as well as foundry rejections! It is the ladle addition that melts easily and diffuses thoroughly.

Investigate this new low-cost iron alloy. You'll find it an economy — not an expense.

Sales Agents:

Debevoise-Anderson Company
New York—Boston—Philadelphia

Rogers, Brown & Crocker Bros., Inc.
Cincinnati-Chicago-Cleveland-Pittsburgh

H. L. E. Meyers, Jr., Co.
San Francisco, Cal.

DRIVER-HARRIS COMPANY
HARRISON, NEW JERSEY

Chicago - Detroit - Morristown,N.J. - England - France

Alloy Makers since 1899

GRADE B Nichrome

TRADE MARK REG. U. S. PAT. OFF.

Continual Duplication A Factor in Carborundum Service

REG. U.S. PAT. OFF.

THE ability of The Carborundum Company to produce and reproduce successful grinding wheels to meet any definite grinding condition means that a constant dependable source of supply is always assured.

¶It means that here is an organization, trained to the building of two or two thousand grinding wheels, as like as the proverbial two peas in a pod—wheels that will be positive in their grading—absolutely uniform in structure—identical in grit—exact in size and shape.

¶The duplication of grinding wheels for all classes of work is another problem which has been successfully solved by Carborundum research and resource.

Carborundum is the Registered Trade Name used by The Carborundum Company for Silicon Carbide. This Trade Mark is the exclusive property of The Carborundum Company.

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.
Reg. U. S. Pat. Off.

CANADIAN CARBORUNDUM CO., LTD., NIAGARA FALLS, ONT.

Sales Offices and Warehouses in

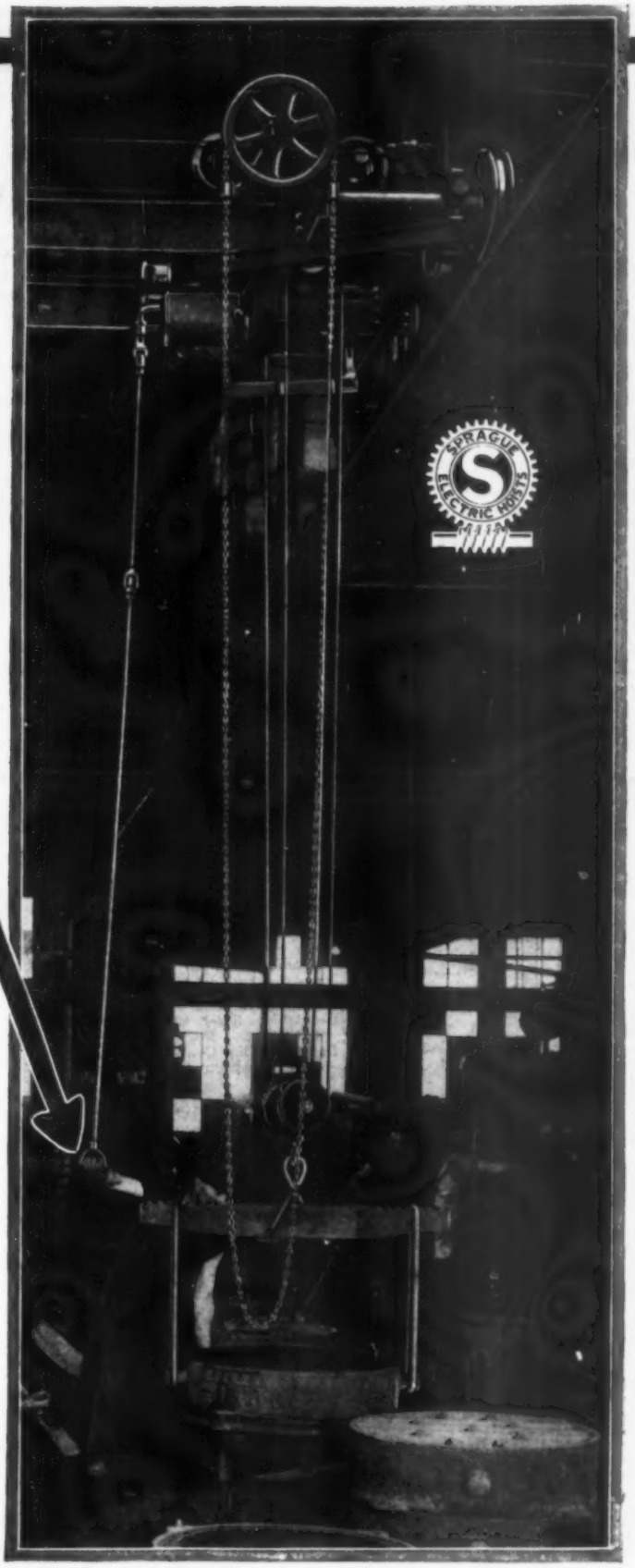
New York, Chicago, Boston, Philadelphia, Cleveland, Detroit, Cincinnati, Pittsburgh, Milwaukee, Grand Rapids

The Carborundum Co., Ltd., Manchester, England

Deutsche Carborundum Werke, Dusseldorf, Germany

"a simple twist of the wrist"

SPRAGUE ROD CONTROL *for* FOUNDRIES



A twist for "up", a twist for "down"—all done by one hand, allowing the operator a free hand to guide his load.

Furthermore, both hands can be free, for the hoist will run at any speed until controller is turned off or turned to next speed. Oversize motors allow lifting of full load at any speed.

This exclusive Sprague feature provides an ideal hoist arrangement that saves time and provides precision in drawing patterns, lowering copes, and handling flasks. Hoists of this type are supplied in capacities of ½ ton to 6 tons for direct current only.

Sprague Electric Hoists have worm drive, automatic lubrication, are simple in construction, thoroughly enclosed and of a design that has proved eminently successful for over 20 years.

A bulletin descriptive of the Sprague line, we shall gladly send on request.

SPRAGUE ELECTRIC HOISTS

DIVISION OF
SHEPARD ELECTRIC CRANE & HOIST CO.

30 CHURCH ST. NEW YORK, N.Y.

"Where-To-Buy"

A classified-by-products list of advertisers for the convenience of readers. If you don't find what you want, write us and we will tell you where to get it. ¶Index to advertisements will give you page number of any advertiser and by referring to advertisement you can get full particulars about products.

ABRASIVE WHEELS
Carborundum Co., Niagara Falls, N. Y.
Strand, N. A., & Co., 5001-5009 North Lincoln St., Chicago, Ill.

ABRASIVES (Metallic)
Globe Steel Abrasive Co., Dept. F., Mansfield, O.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Steel Shot & Grit Co., 61st & A. V. Ry., Pittsburgh, Pa.

ABRASIVES (Metallic Sandblast)
American Steel Abrasives Co., Galion, O.

ACETYLENE DISSOLVED OR IN CYLINDERS
International Oxygen Co., Newark, N. J.
Prest-O-Lite Co., Inc., 30 E. 42nd St., New York City.

ACETYLENE GENERATORS
Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.
Oxweld Acetylene Co., Newark, N. J.

AIR COMPRESSORS
Bury Compressor Co., 1746 Cascade St., Erie, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.
Curtis Pneumatic Machinery Co., 1573 Kienlen Ave., St. Louis, Mo.
General Electric Co., Schenectady, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York City.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Sullivan Machinery Co., 122 S. Michigan Ave., Chicago, Ill.
Westinghouse Traction Brake Co., Wilmerding, Pa.

AIR REDUCER AND STRAINER
Fisher Governor Co., Marshalltown, Iowa.

AIR SEPARATORS—See SEPARATORS (Air, Moisture, Oil)

AIR TOOLS—See TOOLS (Pneumatic)

ALKALI
Mathieson Alkali Works, Inc., 250 Park Ave., New York City

ALLOYS
Alloys & Products, Inc., Oak Point Ave. & Barry St., New York City.
Driver-Harris Co., Harrison, N. J.
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.
Metal & Thermit Corp., 120 Broadway, New York City.
Niagara Falls Smelting & Refining Corp., 2204 Elmwood St., Buffalo, N. Y.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.
Williams & Company, Inc., 901-37 Pennsylvania Ave., Pittsburgh, Pa.

ALLOYS (Boronic)
American Boron Products Co., Inc., Ramsdell & Elmwood Ave., Buffalo, N. Y.

ALUMINUM
British Aluminium Co., 165 Broadway, New York City.

ALUMINUM (Alloys and Ingots)
British Aluminium Co., 165 Broadway, New York City.
Niagara Falls Smelting & Refining Corp., 2204 Elmwood St., Buffalo, N. Y.

ANNEALING OVENS—See OVENS (Annealing)

ARC WELDING EQUIPMENT
General Electric Co., Schenectady, N. Y.

ARCHITECTS (Industrial)
Austin Co., The, 16112 Euclid Ave., Cleveland, O

BABBITT METAL
Ajax Metal Co., 46 Richmond St., Philadelphia, Pa.

BAND SAWS—See SAWS (Metal Band)

BANDS, SNAP FLASK (Steel)
Adams Co., The, 175 Foster St., Dubuque, Iowa
Truscon Steel Co., Youngstown, O

BARROWS (Foundry)
Penn Foundry & Mfg. Co., Reading, Pa.

BARS (Iron and Steel)
Bethlehem Steel Co., Bethlehem, Pa.
Bourne-Fuller Co., 1912 Scranton Rd., Cleveland, O.

BARS, STEEL (Electric Furnace)
Timken Roller Bearing Co., Canton, O.

BEARINGS (Roller)
Timken Roller Bearing Co., Canton, O.

BEARINGS (Thrust)
Timken Roller Bearing Co., Canton, O.

BENCHES (Patternmakers)
Diamond Clamp & Flask Co., Richmond, Ind.

BINDERS—See CORE BINDERS

BLACKING MIXTURE
Dixon, Joseph, Crucible Co., Jersey City, N. J.
McCormick, J. S., Co., 2428 Railroad St., Pittsburgh, Pa.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

BLOW COCKS
Adams Co., The, 175 Foster St., Dubuque, Iowa.

BLOWERS
General Electric Co., Schenectady, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York City.
Knickerbocker Co., The, Jackson, Mich.
McCormick, J. S., Co., 2428 Railroad St., Pittsburgh, Pa.
Spencer Turbine Co., Hartford, Conn.

BLOWPIPES (Brazing, Cutting, Welding, Etc.)
Oxweld Acetylene Co., Newark, N. J.

BOILER TUBES
Williams & Company, Inc., 901-37 Pennsylvania Ave., Pittsburgh, Pa.

BOLTS AND NUTS
Bethlehem Steel Co., Bethlehem, Pa.
Bourne-Fuller Co., 1912 Scranton Rd., Cleveland, O.

BOOKS (Technical)
Penton Publishing Co., Cleveland, O.

BOTTOM PLATES (Steel)
Diamond Clamp & Flask Co., Richmond, Ind.
Truscon Steel Co., Youngstown, O.

BOXES (Tote)
Truscon Steel Co., Youngstown, O.

BRASS (Rods and Pipe)
Williams & Company, Inc., 901-37 Pennsylvania Ave., Pittsburgh, Pa.

BRICKS (Rubbing and Scouring)
Carborundum Co., Niagara Falls, N. Y.

BRIDGES & BUILDINGS (Steel)
American Bridge Co., 71 Broadway, New York City.

BRONZE (Manganese)
Ajax Metal Co., 46 Richmond St., Philadelphia, Pa.

BRUSHES (Motor and Generator)
Dixon, Joseph, Crucible Co., Jersey City, N. J.
General Electric Co., Schenectady, N. Y
United States Graphite Co., Saginaw, Mich,

BUCKETS (Clam Shell, Drag Line, Grab)
Brosius, Edgar E., 19th St. & P. R. R., Sharpsburg P. O., Pittsburgh, Pa.
Harnischfeger Corporation, 3800 National Ave., Milwaukee, Wis.
Hayward Co., 50-56 Church St., New York City.
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.
Williams, G. H., Co., 611 Harbarger Lane, Erie, Pa.

BUCKETS (Foundry)
Penn Foundry & Mfg. Co., Reading, Pa.

BUCKET LOADERS FOR SAND MILLS
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.

BUFFING COMPOSITIONS
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

BUILDINGS (Foundry, Factory, Industrial)
Austin Co., The, 16112 Euclid Ave., Cleveland, O.
Truscon Steel Co., Youngstown, O.

BUILDINGS (Steel)
Swartwout Co., The, 18511 Euclid Ave., Cleveland, O.

BURNERS (Acetylene)—See TORCHES AND BURNERS (Acetylene, Blow, Oxyacetylene)

BURNERS (Oil)
Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.
Hauck Manufacturing Co., 126 Tenth St., Brooklyn, N. Y.

BURNERS (Oil and Gas)
Hagan, Geo. J., Co., Chamber of Commerce, Pittsburgh, Pa.

CALKING HAMMERS (Pneumatic)
Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.

CAR PULLERS (Electric Capstan)
Sprague Electric Hoist Division of Shepard Electric Crane & Hoist Co., 30 Church St., New York City.

CARBON BURNING APPARATUS
Oxweld Acetylene Co., Newark, N. J.

CARBON RODS AND PASTE FOR WELDING
Oxweld Acetylene Co., Newark, N. J.

CARS (Annealing, Billet, Furnace Charging, Core Oven, Pig Iron)
Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.
Penn Foundry & Mfg. Co., Reading, Pa.

CARS (Platform, Industrial Railway, Transfer, Narrow Gage)
Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.
Northern Engineering Works, 2605 Atwater St., Detroit, Mich.
Penn Foundry & Mfg. Co., Reading, Pa.

CARS (Sandblast)
Pangborn Corp., Hagerstown, Md.

CASTINGS (Gray Iron)
Bethlehem Steel Co., Bethlehem, Pa.

CASTINGS (Heat Resistant)
Driver-Harris Co., Harrison, N. J.

CASTINGS (Nickel Chromium)
Driver-Harris Co., Harrison, N. J.

CEMENT (Fire Brick)
Quigley Furnace Specialties Co., 26 Cortlandt St., New York City.

DIAMOND SAND BLAST

DIAMOND

Sand Blast Sand

Not a crushed rock—but a natural, round, uniform sized, bullet-like grain of extreme hardness. Mined from St. Peter's sandstone—thoroughly washed—dried—screened—and dust free.

Also Special Grades of Core, Steel Molding and Furnace Bottom Sands.

Produced Exclusively by

Ottawa Silica Co.

Ottawa, Illinois

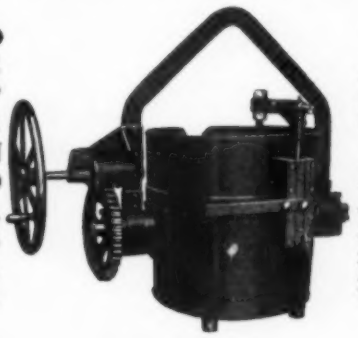
WHITING

ELECTRIC TRAVELING CRANES
FOUNDRY EQUIPMENT
RAILROAD SPECIALTIES

WHITING CORPORATION
15607 Lathrop Ave. Harvey, Ill.

TIECO PRODUCTS

DEPENDABLE



SAFE STURDY

FOUNDRY EQUIPMENT THAT ENDURES

The Industrial Equipment Co.
115 Ohio St.
Minster, Ohio

Dumping Buckets **FOR ALL USES** **Industrial Cars or Trucks**

PENN FOUNDRY & MFG. CO., Evans Ave., Reading, Pa.

WHERE TO BUY

CEMENT (Furnace)
Dixon, Joseph, Crucible Co., Jersey City, N. J.
Fisher, Alfred, Furnace Co., 803 W. Madison St., Chicago, Ill.
Lava Crucible Co. of Pittsburgh, Wabash Bldg., Pittsburgh, Pa.

CEMENT (High Temperature, Refractory)
Lava Crucible Co. of Pittsburgh, Wabash Bldg., Pittsburgh, Pa.
Quigley Furnace Specialties Co., 26 Cortlandt St., New York City.

CEMENT (Iron and Steel)
Smooth-On Mfg. Co., 572 Communipaw Ave., Jersey City, N. J.

CEMENT (Iron, Steel, Brass)
McCormick, J. S., Co., 2428 Railroad St., Pittsburgh, Pa.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

CEMENT (Metallic)
Smooth-On Mfg. Co., 572 Communipaw Ave., Jersey City, N. J.

CHAIN BELTING
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.

CHAIN DRIVES (Silent)
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.

CHARGING EQUIPMENT (Air Furnace)
American Foundry Equipment Co., Mishawaka, Ind.

CHEMICALS
Mathieson Alkali Works, Inc., 250 Park Ave., New York City.

CHEMISTS
Kawin, Chas. C., Co., 431 South Dearborn St., Chicago, Ill.

CHIPPERS (Pneumatic) — See HAMMERS (Chipping and Riveting, Pneumatic)

CHISEL BLANKS (Pneumatic)
Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.

CINDER MILLS
Sly, W. W., Mfg. Co., 4702 Train Ave., Cleveland, O.

CLAMPS (Core Boxes)
Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

CLAMPS (Flask)
Diamond Clamp & Flask Co., Richmond, Ind.
Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

CLAMPS (Hose)—See HOSE CLAMPS

CLAMPS (Malleable Iron)
Malleable Iron Fittings Co., Branford, Conn.

CLAMPS (Patternmakers)
Diamond Clamp & Flask Co., Richmond, Ind.

CLAY (Fire)—See FIRE CLAY

CLOTH (Abrasive)
Carborundum Co., Niagara Falls, N. Y.

CLOTHING (Asbestos, Leather, Fireproofed Duck)
Safety Clothing Co., 3800 Payne Ave., Cleveland, O.

CLUTCHES (Magnetic)
Magnetic Mfg. Co., 241 24th Ave., Milwaukee, Wis.

COAL
Hanna, M. A., Co., The, Leader Bldg., Cleveland, O.
Hillman Coal & Coke Co., First Nat'l Bank Bldg., Pittsburgh, Pa.

COAL CRUSHERS AND PULVERIZERS
Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.

COAL HANDLING MACHINERY
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.

COAL, ORE AND ASH HANDLING MACHINERY
Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.
Sprague Electric Hoist Division of Shepard Electric Crane & Hoist Co., 30 Church St., New York City.

COKE
Bethlehem Steel Co., Bethlehem, Pa.
Hanna, M. A., Co., The, Leader Bldg., Cleveland, O.
Hillman Coal & Coke Co., First Nat'l Bank Bldg., Pittsburgh, Pa.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

COMPRESSORS (Air)—See AIR COMPRESSORS

CONDENSERS (Surface and Low Level Jet)
Ingersoll-Rand Co., 11 Broadway, New York City.

CONSTRUCTION (Foundry Buildings)—See BUILDINGS (Foundry, Factory, Industrial)

CONSULTING FOUNDRY SPECIALISTS
Vickers, Chas., 60 S. Elmwood Ave., Buffalo, N. Y.

CONTRACTORS — See ENGINEERS AND CONTRACTORS

CONVEYING AND ELEVATING EQUIPMENT
Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.

CONVEYING EQUIPMENT (Overhead For Factories)
Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.

CONVEYING SYSTEMS
Arcade Mfg. Co., Dept. D., Freeport, Ill.
Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.
Mathews Conveyer Co., Ellwood City, Pa.

CONVEYORS (Ash, Coal)
Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.

CONVEYORS (Belt, Bucket and Chain)
Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.

CONVEYORS (Gravity)
Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.
Mathews Conveyer Co., Ellwood City, Pa.

CONVEYORS (Pig Iron)
Mathews Conveyer Co., Ellwood City, Pa.

COPPER (Boronic)
American Boron Products Co., Inc., Ramsdell and Elmwood Ave., Buffalo, N. Y.

COPPER (Rods and Pipe)
Williams & Company, Inc., 901-37 Pennsylvania Ave., Pittsburgh, Pa.

CORE BENCHES
Malleable Iron Fittings Co., Branford, Conn.

CORE BINDERS
Corn Products Refining Co., 17 Battery Place, New York City.
Kellogg, Spencer, & Sons, Inc., Buffalo, N. Y.
Knefler-Bates Manufacturing Co., Indianapolis, Ind.
Mifflin Chemical Corp., Delaware Ave. and Tasker St., Philadelphia, Pa.
Smith, Werner G., Co., 2191 W. 110th St., Cleveland, O.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

CORE BOXES (Steel and Wood)
Diamond Clamp & Flask Co., Richmond, Ind.
Truscon Steel Co., Youngstown, O.

CORE BREAKERS
Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.
Ingersoll-Rand Co., 11 Broadway, New York City.
Sullivan Machinery Co., 122 S. Michigan Ave., Chicago, Ill.

CORE COMPOUND
Corn Products Refining Co., 17 Battery Place, New York City.
Kellogg, Spencer, & Sons, Inc., Buffalo, N. Y.
Lindsay-McMillan Co., 930 South Water St., Milwaukee, Wis.
Smith, Werner G., Co., 2191 W. 110th St., Cleveland, O.
Stevens, Ferederic B., Inc., Larned and Third Sts., Detroit, Mich.

CORE DRYING PLATES—See PLATES (Core Drying)

CORE FLOUR
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

CORE MAKING MACHINES
American Foundry Equipment Co., Mishawaka, Ind.
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Demmler, Wm., & Brothers, Kewanee, Ill.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh, Pa.
International Molding Machine Co., 2616 W. 16th St., Chicago, Ill.
McCormick, J. S., Co., 2428 Railroad St., Pittsburgh, Pa.
Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

CORE OILS
Kellogg, Spencer, & Sons, Inc., Buffalo, N. Y.
Lindsay-McMillan Co., 930 South Water St., Milwaukee, Wis.
Mifflin Chemical Corp., Delaware Ave. and Tasker St., Philadelphia, Pa.
Robinson, Wm. C., & Son Co., Caroline & Dock Sts., Baltimore, Md.
Smith, Werner G., Co., 2191 W. 110th St., Cleveland, O.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

CORE OVENS
Fisher, Alfred, Furnace Co., 803 W. Madison St., Chicago, Ill.
Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.
Holcroft & Co., 6545 Epworth Blvd., Detroit, Mich.
McCann-Harrison Corp., 5005 Euclid Ave., Cleveland, O.
McCormick, J. S., Co., 2428 Railroad St., Pittsburgh, Pa.
Marshall Blow Pipe Co., 7431 Dubois St., Detroit, Mich.
Sly, W. W., Mfg. Co., The, 4702 Train Ave., Cleveland, O.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.
Swartwout Co., The, 18511 Euclid Ave., Cleveland, O.
Young Brothers Co., 6508 Mack Ave., Detroit, Mich.

CORE PLATES (Steel)
Moltrup Steel Products Co., Beaver Falls, Pa.
Truscon Steel Co., Youngstown, O.

CORE RACKS
Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.
Marshall Blow Pipe Co., 7431 Dubois St., Detroit, Mich.
Sly, W. W., Mfg. Co., The, 4702 Train Ave., Cleveland, O.
Truscon Steel Co., Youngstown, O.

CORE REDUCERS
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.

CORE ROD STRAIGHTENING AND CUTTING MACHINES
American Foundry Equipment Co., Mishawaka, Ind.

CORE RODS (Steel)
Truscon Steel Co., Youngstown, O.

CORE ROOM EQUIPMENT
Truscon Steel Co., Youngstown, O.

CORE SAND MIXERS
American Foundry Equipment Co., Mishawaka, Ind.
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.
Standard Sand & Machine Co., The, 5151 St. Clair Ave., Cleveland, O.

CORE TRAYS (Steel)
Truscon Steel Co., Youngstown, O.

CORE WASH
McCormick, J. S. Co., 2428 Railroad St., Pittsburgh, Pa.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.
United States Graphite Co., Saginaw, Mich.

CRANES
Northern Engineering Works, 2605 Atwater St., Detroit, Mich.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

CRANES (Bucket)
Harnischfeger Corporation, 3800 National Ave., Milwaukee, Wis.
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.
Milwaukee Electric Crane & Mfg. Corp., Milwaukee, Wis.
Northern Engineering Works, 2605 Atwater St., Detroit, Mich.

CRANES (Electric Traveling)
Harnischfeger Corporation, 3800 National Ave., Milwaukee, Wis.
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.
Milwaukee Electric Crane & Mfg. Corp., Milwaukee, Wis.
Northern Engineering Works, 2605 Atwater St., Detroit, Mich.
Scully-Jones & Co., 2012 W. 13th St., Chicago, Ill.

For Sounder Castings—

use BRISTOL'S Pyrometers. They enable your men to pour every mold at *exactly* the right temperature.

The high resistance principle on which the BRISTOL is built insures its accuracy in determining temperatures up to 3000°F.

Write for Bulletin

The Bristol Company *Waterbury, Connecticut*

FOR 38 YEARS — Ask Any Technical Engineer — MAKERS OF

BRISTOL'S — RECORDING — INSTRUMENTS

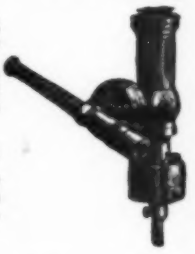
Hardness Testing

with the SCLEROSCOPE gives you the advantage over your competitors. Our *booklet* on the Science and Testing of metals will be sent free on request.

Heat Indications

in the Foundry are now most successfully made with the Pyroscope. Inexpensive, simple, etc.

Pamphlet free



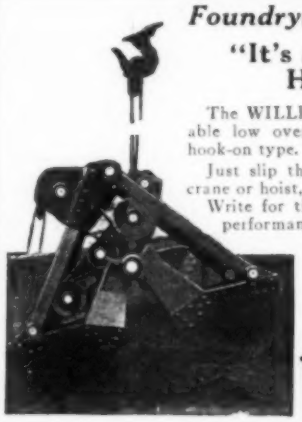
The Shore Instrument & Mfg. Co.

INCORPORATED

Van Wyck Ave. and Carll St. Jamaica, N. Y.

Foundrymen say—

"It's a faster and handier Hook-on Bucket"



The WILLIAMS "Foundry" Bucket has remarkable low overhead clearance for a bucket of the hook-on type.

Just slip the holding yoke over the hook of any crane or hoist, and get *instant service*, indoors or out. Write for the new Williams Bucket Book giving performance records, and complete description.

G. H. Williams Company
612 Haybarger Lane, Erie, Pa.

Branch Offices:
New York, Pittsburgh, Cleveland, Chicago

WILLIAMS
FAST-DIGGING BUCKETS

8 *split seconds* to stop spoilage

Dip—press—read! Eight split seconds to know the exact temperature of the metal in the ladle. There are no wires, no battery, no protection tubes or other accessories.

No adjustments, no calculations. Accurate every time. Any workman can do it.

Many of the biggest—and many of the *smallest* non-ferrous foundries in the world are saving money with it every day.

MORE THAN 2000 ARE IN USE

One of the foremost die casters in the country writes, "The simplicity in handling, the short time necessary for operation and the true temperature reading make the Pyro a real friend and helper to executive foremen and die casting operators."

TRY ONE ON APPROVAL

Try it. See for yourself how it saves its cost over and again. Just write us on your regular business letterhead.

PYROMETER INSTRUMENT CO.
74 Reade St., New York

Pyro

Insertion Pyrometer

2027

WHERE TO BUY

CRANES (Gantry)
Northern Engineering Works, 2605 Atwater St., Detroit, Mich.

CRANES (Hand Traveling)
Cleveland Crane & Engineering Co., Wickliffe, O.
Curtis Pneumatic Machinery Co., 1573 Kienlen Ave., St. Louis, Mo.
Harnischfeger Corporation, 3800 National Ave., Milwaukee, Wis.
Northern Engineering Works, 2605 Atwater St., Detroit, Mich.
Scully-Jones & Co., 2012 W. 13th St., Chicago, Ill.

CRANES (Jib)
Curtis Pneumatic Machinery Co., 1573 Kienlen Ave., St. Louis, Mo.
Harnischfeger Corporation, 3800 National Ave., Milwaukee, Wis.
Northern Engineering Works, 2605 Atwater St., Detroit, Mich.
Scully-Jones & Co., 2012 W. 13th St., Chicago, Ill.

CRANES (Locomotive)
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.

CRANES (Overhead)
Northern Engineering Works, 2605 Atwater St., Detroit, Mich.

CRANES (Wall)
Harnischfeger Corporation, 3800 National Ave., Milwaukee, Wis.
Milwaukee Electric Crane & Mfg. Corp., Milwaukee, Wis.
Northern Engineering Works, 2605 Atwater St., Detroit, Mich.

CRUCIBLE LIFTERS
Foundry Equipment Co., 1831 Columbus Rd., Cleveland, O.

CRUCIBLES
Bartley, Jonathan, Crucible Co., Trenton, N. J.
Chicago Crucible Co., 2525 Clybourne Ave., Chicago, Ill.
Dixon, Jos., Crucible Co., Jersey City, N. J.
Lava Crucible Co. of Pittsburgh, Wabash Bldg., Pittsburgh, Pa.
Naugatuck Valley Crucible Co., Shelton, Conn.
Ross-Tacony Crucible Co., Tacony, Philadelphia, Pa.
Vesuvius Crucible Co., Swissvale, Pa.

CRUSHED STEEL — See STEEL (Crushed)

CUPOLA BLOCKS
Queen's Run Refractories Co., Lock Haven, Pa.
U. S. Refractories Corp., Mt. Union, Pa.

CUPOLA BLOWERS
General Electric Co., Schenectady, N. Y.
Spencer Turbine Co., Hartford, Conn.

CUPOLA BRICK
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

CUPOLA CHARGING MACHINES (Electric)
Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.

CUPOLA DAUB
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

CUPOLA LIGHTERS
Hauck Mfg. Co., 126 Tenth St., Brooklyn, N. Y.

CUPOLAS
Northern Engineering Works, 2605 Atwater St., Detroit, Mich.
Sly, W. W., Mfg. Co., The, 4702 Train Ave., Cleveland, O.

CUTTERS (Steel)
Moltrup Steel Products Co., Beaver Falls, Pa.

CUTTING AND WELDING (Oxy-acetylene)—See WELDING AND CUTTING APPARATUS AND SUPPLIES (Oxy-acetylene)

CUTTING AND WELDING EQUIPMENT (Electric Arc)—See WELDING AND CUTTING EQUIPMENT (Electric Arc)

CYLINDERS (Acetylene) — See ACETYLENE IN CYLINDERS

CYLINDERS (Oxygen)—See OXYGEN IN CYLINDERS

DECARBONIZNG APPARATUS
Oxweld Acetylene Co., Newark, N. J.

DEOXIDIZERS
Alloys & Products, Inc., Oak Point Ave. and Barry St., New York City.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

DESULPHURIZER
Alloys & Products, Inc., Oak Point Ave. and Barry St., New York City.
Mathieson Alkali Works, Inc., 250 Park Ave., New York City.

DISCS (Grinding)
Carborundum Co., Niagara Falls, N. Y.

DOWEL PINS (Brass)
Diamond Clamp & Flask Co., Richmond, Ind.

DRILLS (Electric)
Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.

DRILLS (Pneumatic)
Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.

DRYERS (Sand) — See SAND DRYERS

DUST ARRESTING SYSTEMS
American Foundry Equipment Co., Mishawaka, Ind.
Knickerbocker Co., The, Jackson, Mich.
New Haven Sand Blast Co., New Haven, Conn.
Pangborn Corp., Hagerstown, Md.
Sly, W. W., Mfg. Co., 4702 Train Ave., Cleveland, O.

ELECTRICAL EQUIPMENT
General Electric Co., Schenectady, N. Y.

ELEVATORS
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.

ELEVATORS (Bucket)
Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.

ENGINEERS (Consulting) — See ENGINEERS (Foundry, Mechanical, Electrical, etc.)

ENGINEERS (Foundry, Mechanical, Electrical, etc.)
Austin Co., The, 16112 Euclid Ave., Cleveland, O.
Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.
Kawin, Charles C., Co., 431 South Dearborn St., Chicago, Ill.
Standard Sand & Machine Co., 5151 St. Clair Ave., Cleveland, O.

ENGINEERS AND CONTRACTORS
Austin Co., The, 16112 Euclid Ave., Cleveland, O.

ENGINES (Oil)
Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.

ENGINES (Oil, Gas, Steam)
Ingersoll-Rand Co., 11 Broadway, New York City.

EXHAUST SYSTEMS
American Foundry Equipment Co., Mishawaka, Ind.
General Electric Co., Schenectady, N. Y.
New Haven Sand Blast Co., New Haven, Conn.
Pangborn Corp., Hagerstown, Md.
Sly, W. W., Mfg. Co., 4702 Train Ave., Cleveland, O.

EYE PROTECTORS — See GOGGLES AND EYE PROTECTORS

FACING SAND MIXERS
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.
Standard Sand & Machine Co., The, 5151 St. Clair Ave., Cleveland, O.

FACINGS
Dixon, Jos., Crucible Co., Jersey City, N. J.
Knefler-Bates Manufacturing Co., Indianapolis, Ind.
McCormick, J. S., Co., 2428 Railroad St., Pittsburgh, Pa.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.
United States Graphite Co., Saginaw, Mich.

FANS
General Electric Co., Schenectady, N. Y.

FERROALLOYS
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.
Williams & Co., Inc., 901-37 Penn. Ave., Pittsburgh, Pa.

FERROCARBON-TITANIUM
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

FERROCHROME
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.
Williams & Company, Inc., 901-37 Pennsylvania Ave., Pittsburgh, Pa.

FERROMANGANESE
Bethlehem Steel Co., Bethlehem, Pa.
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.
Foundry Manganese Co., 208 Harrison Bldg., Philadelphia, Pa.
Williams & Company, Inc., 901-37 Pennsylvania Ave., Pittsburgh, Pa.

FERROSILICON
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.
Foundry Manganese Co., 208 Harrison Bldg., Philadelphia, Pa.
Williams & Company, Inc., 901-37 Pennsylvania Ave., Pittsburgh, Pa.

FILLERS (Metallic)
Smooth-On Mfg. Co., 572 Communipaw Ave., Jersey City, N. J.

FIRE BRICK AND CLAY
Carborundum Co., Niagara Falls, N. Y.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

FIRE CLAY
Illinois Clay Products Co., Barber Bldg., Joliet, Ill.

FIRE SAND
Carborundum Co., Niagara Falls, N. Y.

FLASK FITTINGS
Diamond Clamp & Flask Co., Richmond, Ind.
Truscon Steel Co., Youngstown, O.

FLASKS
Adams Co., The, 175 Foster St., Dubuque, Iowa.
American Foundry Equipment Co., Mishawaka, Ind.
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Diamond Clamp & Flask Co., Richmond, Ind.
Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.
Truscon Steel Co., Youngstown, O.

FLOUR (Foundry)
American Tripoli Co., Seneca, Mo.
Knefler-Bates Manufacturing Co., Indianapolis, Ind.

FLUOR SPAR
Hillside Fluor Spar Mines, 38 S. Dearborn St., Chicago, Ill.

FLUX (Iron, Brass, Steel, etc.)
Oxweld Acetylene Co., Newark, N. J.

FLUX (Welding)
Oxweld Acetylene Co., Newark, N. J.

FLUXES
Mathieson Alkali Works, Inc., 250 Park Ave., New York City.

FORGINGS (Pressed and Drop)
Bethlehem Steel Co., Bethlehem, Pa.

FOUNDRY ADVISORS
Kawin, Charles C., Co., 431 South Dearborn St., Chicago, Ill.

FOUNDRY AND FACTORY BUILDINGS — See BUILDINGS (Foundry, Factory, Industrial)

FOUNDRY ENGINEERS—See ENGINEERS (Foundry, Mechanical, Electrical, etc.)

FOUNDRY EQUIPMENT
Adams Co., The, 175 Foster St., Dubuque, Iowa.
American Foundry Equipment Co., Mishawaka, Ind.
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Axmann Sand-Throwing Machine Co., 1833 Columbus, Rd., Cleveland, O.
Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.
Beardsley & Piper Co., 2541 N. Keeler Ave., Chicago, Ill.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland, O.
Foundry Supplies Mfg. Co., 2221 Orchard St., Chicago, Ill.
Industrial Equipment Co., Minster, O.
International Molding Machine Co., 2616 W. 16th St Chicago, Ill.
McCormick, J. S., Co., 2428 Railroad St., Pittsburgh, Pa.
Mott Sand Blast Mfg. Co., 4611-21 Flourney St., Chicago, Ill.
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.
New Haven Sand Blast Co., New Haven, Conn.
Northern Engineering Works, 2605 Atwater St., Detroit, Mich.
Penn Foundry & Mfg. Co., Reading, Pa.
Sly, W. W., Mfg. Co., 4702 Train Ave., Cleveland, O.
Standard Sand & Machine Co., 5151 St. Clair Ave., Cleveland, O.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.
Tabor Manufacturing Co., 6225 Tacony, St., Philadelphia, Pa.
Truscon Steel Co., Youngstown, O.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

FOUNDRY EQUIPMENT (Second Hand)
Clifton-Pratt Co., The, Cincinnati, O.
Scully-Jones & Co., 2012 W. 13th St., Chicago, Ill.

Rotary Filing
Grinding
Drilling
Polishing

Strand
FLEXIBLE SHAFTS

Established 1905

Flexible Shaft Machines for the Metal Pattern Shop and Foundry

Type MP5.
¼ H.P.

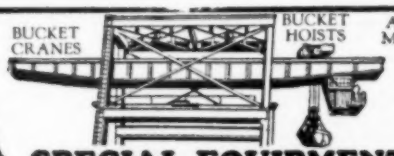
Type M7.
1 H.P.

Low Upkeep
Splendid Results
Thousands in use
Write for catalog.

Manufactured by

N. A. Strand & Co.
5001 North Lincoln St. Chicago.

SINGLE HOOK



BUCKET CRANES

BUCKET HOISTS

AUTO-MATIC

SPECIAL EQUIPMENT

Edgar E. Brosius, Inc. Engineers and Manufacturers SHARPSBURG P. O. PITTSBURGH, PA.

ELECTRIC MOTOR BUCKETS

Hayward Buckets

"Dig for all the World"

THE HAYWARD COMPANY

50-56 Church St., New York, N.Y.

A SYMBOL OF SERVICE

POSITIVE OIL LUBRICATION

LONG SERVICE AT LOW COST

~SEND FOR CATALOG~

MILWAUKEE ELECTRIC CRANE & MFG. CORP. MILWAUKEE, WIS.

MILWAUKEE CRANES & HOISTS

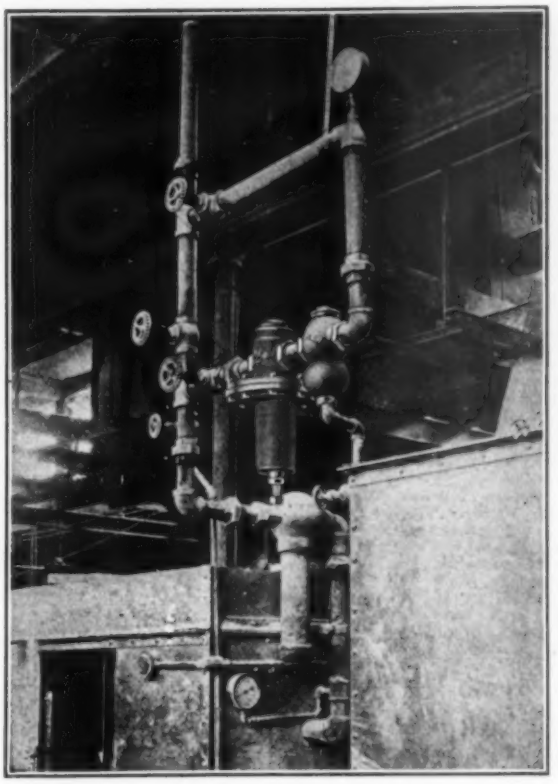
Increase your Molding Production with *MODERN* Pouring Devices

Models from 100 to 1000 Pounds Capacity.
Write for full details.

MODERN POURING DEVICE CO.
PORT WASHINGTON, WIS.

FISHER QUALITY

costs less than a breakdown



The rugged construction—the lifetime durability that is built into Fisher Regulators assures you of a DEPENDABLE control of air pressure.

Combining great strength with perfect accuracy Fisher Regulators will give you the most effective control of air pressure in YOUR Plant,—insuring efficient work.

The Fisher Governor Co.
1406 Fisher Bldg.
Marshalltown, Iowa

FISHER
TRADE MARK
REGISTERED

WHERE TO BUY

FOUNDRY SPECIALISTS
Beardsley & Piper Co., 2541 N Keeler Ave., Chicago, Ill.
Sly, W. W., Mfg. Co., 4702 Train Ave., Cleveland, O.

FOUNDRY SUPPLIES
Beardsley & Piper Co., 2541 N. Keeler Ave., Chicago, Ill.
Champion Foundry & Machine Co., 2419 W. 14th St., Chicago, Ill.
Demmler, Wm., & Brothers, Kewanee, Ill.
McCormick, J. S., 2428 Railroad St., Pittsburgh, Pa.
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

FURNACE LININGS
Carborundum Co., Niagara Falls, N. Y.

FURNACE LININGS (Graphite)
Dixon, Jos., Crucible Co., Jersey City, N. J.

FURNACES
Swindell, Wm., & Bros., P. O. Box 1753, Pittsburgh, Pa.

FURNACES (Annealing and Case Hardening)
McCann-Harrison Corp., 5005 Euclid Ave., Cleveland, O.

FURNACES (Brass and Aluminum)
Fisher, Alfred, Furnace Co., 803 W. Madison St., Chicago, Ill.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Pittsburgh Electric Furnace Corp., 32nd St. & Putney Way, Pittsburgh, Pa.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

FURNACES (Crucible Steel)
Foundry Equipment Co., 1831 Columbus Rd., Cleveland, O.

FURNACES (Electric-Brass and Aluminum)
Ajax Metal Co., 46 Richmond St., Philadelphia, Pa.
Detroit Electric Furnace Co., 2231 Park Ave., Detroit, Mich.
General Electric Co., Schenectady, N. Y.
Pittsburgh Electric Furnace Corp., 32nd St. & Putney Way, Pittsburgh, Pa.

FURNACES (Electric for Annealing, Hardening, Drawing, Carbonizing)
Hagan, Geo. J., Co., Chamber of Commerce, Pittsburgh, Pa.
Holcroft & Co., 6545 Epworth Blvd., Detroit, Mich.
Swindell, Wm., & Bros., P. O. Box 1753, Pittsburgh, Pa.

FURNACES (Electric Melting)
American Bridge Co., 71 Broadway, New York City.
Detroit Electric Furnace Co., 2231 Park Ave., Detroit, Mich.
General Electric Co., Schenectady, N. Y.
Pittsburgh Electric Furnace Corp., 32nd St. & Putney Way, Pittsburgh, Pa.
Swindell, Wm., & Bros., P. O. Box 1753, Pittsburgh, Pa.

FURNACES (Melting)
Detroit Electric Furnace Co., 2231 Park Ave., Detroit, Mich.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Pittsburgh Electric Furnace Corp., 32nd St. & Putney Way, Pittsburgh, Pa.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.
Swindell, Wm., & Bros., P. O. Box 1753, Pittsburgh, Pa.

FURNACES (Open Hearth)
Swindell, Wm., & Bros., P. O. Box 1753, Pittsburgh, Pa.

GAGGERS
Bourne-Fuller Co., 1912 Scranton Rd., Cleveland, O.

GAGGERS (Steel)
Franklin Core Rod & Gagger Co., Franklin, Pa.
Truscon Steel Co., Youngstown, O.
United Compound Co., 228 Elk St., Buffalo, N. Y.

GAS (Oxygen and Nitrogen)
Prest-O-Lite Co., Inc., 30 E. 42nd St., New York City.

GAS EXHAUSTERS (Rotary Positive Pressure)
General Electric Co., Schenectady, N. Y.

GAUGES (Welding)
Oxweld Acetylene Co., Newark, N. J.

GEAR HOBBERS
Adams Co., The, 175 Foster St., Dubuque, Iowa.

GEAR TESTERS
Adams Co., The, 175 Foster St., Dubuque, Iowa.

GLOVES (Asbestos)
Oxweld Acetylene Co., Newark, N. J.
Safety Clothing Co., 3800 Payne Ave., Cleveland, O.

GLOVES (Sandblast)
Pangborn Corp., Hagerstown, Md.
Sly, W. W., Mfg. Co., The, 4702 Train Ave., Cleveland, O.

GLUE POTS (Patternshop)
General Electric Co., Schenectady, N. Y.

GOGGLES AND EYE PROTECTORS
Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.
McCormick, J. S., Co., 2428 Railroad St., Pittsburgh, Pa.
Oxweld Acetylene Co., Newark, N. J.

GRAPHITE
United States Graphite Co., The, Saginaw, Mich.

GRAPHITE (Boiler and Lubricating)
Dixon, Jos., Crucible Co., Jersey City, N. J.

GRINDERS (Electric Portable)
Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.
Strand, N. A., & Co., 5001-5009 North Lincoln St., Chicago, Ill.

GRINDERS (Pneumatic Portable)
Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.
Cleveland Pneumatic Tool Co., 3734 E. 78th St., Cleveland, O.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.
Sullivan Machinery Co., 122 S. Michigan Ave., Chicago, Ill.

GRINDING PANS (Sand)
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.
Phillips & McLaren Co., 24th and Smallman Sts., Pittsburgh, Pa.

GRINDING WHEEL PLATES (Steel)
Moltrup Steel Products Co., Beaver Falls, Pa.

GRINDING WHEELS—See ABRASIVE WHEELS

GRIT (Angular and Steel)
American Steel Abrasives Co., Galion, O.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

GUNS (Spray)
Malleable Iron Fittings Co., Branford, Conn.

HACK SAWS—See SAWS (Hack)

HAMMERS (Chipping and Riveting—Pneumatic)
Canton Pneumatic Co., 1718 Ninth St., S. W., Canton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.
Cleveland Pneumatic Tool Co., 3734 E. 78th St., Cleveland, O.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.

HARDENERS
Alloys & Products, Inc., Oak Point Ave. & Barry St., New York City.

HARDNESS TESTING & HEAT MEASURING INSTRUMENTS
Shore Instrument & Mfg. Co., Inc., Van Wyck Ave. & Carll St., Jamaica, L. I., New York.

HEATERS (Direct Oil Fired)
McCann-Harrison Corp., 5005 Euclid Ave., Cleveland, O.

HELMETS
Safety Clothing Co., 3800 Payne Ave., Cleveland, O.

HELMETS (Sandblast)
Pangborn Corp., Hagerstown, Md.
Pulmosan Safety Equipment Corp., 386 Jay St., Brooklyn, N. Y.
Sly, W. W., Mfg. Co., The, 4702 Train Ave., Cleveland, O.

HOISTING MACHINERY
Sprague Electric Hoist Division of Shepard Electric Crane & Hoist Co., 30 Church St., New York City.

HOISTS (Air)
Curtis Pneumatic Machinery Co., 1573 Kienlen Ave., St. Louis, Mo.
Hanna Engineering Works, 1761 Elston Ave., Chicago, Ill.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.
Northern Engineering Works, 2605 Atwater St., Detroit, Mich.

HOISTS (Electric)
General Electric Co., Schenectady, N. Y.
Harnischfeger Corporation, 3800 National Ave., Milwaukee, Wis.
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.
Northern Engineering Works, 2605 Atwater St., Detroit, Mich.
Sprague Electric Hoist Division of Shepard Electric Crane & Hoist Co., 30 Church St., New York City.

HOISTS (Monorail)
Northern Engineering Works, 2605 Atwater St., Detroit, Mich.

HOISTS (Pneumatic)
Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.
Hanna Engineering Works, 1761 Elston Ave., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.

HOISTS (Portable)
Sullivan Machinery Co., 122 S. Michigan Ave., Chicago, Ill.

HOLDERS-ON
Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.

HOODS (Leather Sandblast)
Pangborn Corp., Hagerstown, Md.

HOSE (Pneumatic)
Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.

HOSE (Sandblast)
Pangborn Corp., Hagerstown, Md.
Sly, W. W., Mfg. Co., The, 4702 Train Ave., Cleveland, O.

HOSE (Welding)
Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.
Oxweld Acetylene Co., Newark, N. J.

HOSE CLAMPS
Malleable Iron Fittings Co., Branford, Conn.

HOSE COUPLINGS (Pneumatic)
Cleveland Pneumatic Tool Co., 3734 E. 78th St., S. E., Cleveland, O.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.

INDUSTRIAL RAILWAY EQUIPMENT—See RAILWAY EQUIPMENT

INGOTS (Aluminum)
British Aluminium Co., 165 Broadway, New York City.

INGOTS (Brass, Bronze, Copper, Nickel)
Ajax Metal Co., 46 Richmond St., Philadelphia, Pa.

INSTRUMENTS (Recording)
Bristol Co., The, Waterbury, Conn.

IRON ORE
Hanna, M. A., Co., The, Leader Bldg., Cleveland, O.

JACKETS (Snap Flask Mold)
American Foundry Equipment Co., Mishawaka, Ind.
Diamond Clamp & Flask Co., Richmond, Ind.

JACKETS (Steel)
Adams Co., The, 175 Foster St., Dubuque, Iowa.
Arcade Mfg. Co., Dept. D, Freeport, Ill.

JOLT RAMMING MACHINES
International Molding Machine Co., 2616 W. 16th St., Chicago, Ill.

JOLT RAMMING MACHINES (Pneumatic and Electric)
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh, Pa.
Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

LADLE HEATERS AND DRYERS
Hauck Mfg. Co., 126 Tenth St., Brooklyn, N. Y.

LADLE ALLOYS
Williams & Company, Inc., 901-37 Pennsylvania Ave., Pittsburgh, Pa.

LADLES
Industrial Equipment Co., Minster, O.
McCormick, J. S., Co., 2428 Railroad St., Pittsburgh, Pa.
Northern Engineering Works, 2605 Atwater St., Detroit, Mich.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

Imperial

OXY-ACETYLENE Welding and Cutting Equipment

The improvements in Welding and Cutting Torches which Imperial introduced in January of this year, have been accepted as basic.

The new design, the new mixing principle and the new tip holders all combine to make a better torch, capable of doing better work.

There is an Imperial Outfit specially adapted for the work in your shop. Heavy or light—large or small—welding only or both welding and cutting—there is the *right* Imperial Outfit to do the job efficiently.

Send for our new complete catalog.

THE IMPERIAL BRASS MFG. CO.
1203 W. Harrison St., Chicago

INDUSTRIAL GASES

OXYGEN HYDROGEN
ACETYLENE NITROGEN
I.O.C. SYSTEM

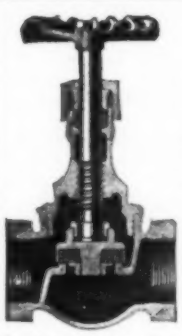
Quick shipment and low prices also on cylinders, valves, torches, regulators and supplies.

INTERNATIONAL OXYGEN CO., Newark, N. J.
Branch Offices: New York, Pittsburgh, Toledo

Aluminothermic Metals and Alloys

25% Ferro-Titanium; many others.
Write for pamphlet No. 2030

METAL & THERMIT CORPORATION
120 Broadway, New York
Pittsburgh Chicago Boston S. San Francisco Toronto



Sectional view, Fig. 106 screwed Jenkins Standard Bronze Globe Valve

In the grind of daily service

In the year in, year out grind of daily service, in the strains of frequent opening and closing, it is the reserve strength of a Jenkins Valve which counts most heavily.

Reserve strength is built into every genuine Jenkins Valve, as a matter of manufacturing policy. Metals are proved by analyses: design and construction provide for even distribution of metal; tests must show that a Jenkins is fit for its job before it leaves the factory.

JENKINS BROS.
80 White Street, New York, N. Y.
Boston, Mass., Philadelphia, Pa., Chicago, Ill.
JENKINS BROS., Ltd., Montreal, Can., London, Eng.

Always marked with the "Diamond"
Jenkins Valves
SINCE 1864

Dry air
—*a foundry necessity*

DRY air reduces pneumatic tool repairs.
Dry air lengthens the life of air hose.

Dry air means more efficient operation of pneumatic equipment.

Dry air is assured by the use of the Gast compressed air separator. It removes the water and oil which rusts and clogs air hoists, molding machines and sand blasts, and which rots the interior of air hose.

The construction of the Gast is simple. The air changes direction several times and passes through a brass screen which forms innumerable small baffles.

You can try out a Gast without charge for thirty days. Write for it.

SMITH-MONROE COMPANY
1910 Main Street South Bend, Ind.

YOU CAN DO IT BETTER WITH A GAST
F12-15—Gray

WHERE TO BUY

LEAD
McCormick, J. S., Co., 2428 Railroad St., Pittsburgh, Pa.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.
United States Graphite Co., The, Saginaw, Mich.

LEGGINGS
Safety Clothing Co.,
3800 Payne Ave., Cleveland, O.

LINSEED OIL (Core)
Kellogg, Spencer, & Sons, Inc., Buffalo, N. Y.
Smith, Werner G., Co.,
2191 W. 110th St., Cleveland, O.

LOADERS (Wagon and Trucks)
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.

LUBRICANTS (Industrial)
Lindsay-McMillan Co.,
930 South Water St.,
Milwaukee, Wis.

MAGNETIC SEPARATORS—See SEPARATORS (Magnetic)

MAGNETS
Dings Magnetic Separator Co.,
675 Smith St., Milwaukee, Wis.
Magnetic Mfg. Co.,
241 24th Ave., Milwaukee, Wis.

MAGNETS (Electro)
Dings Magnetic Separator Co.,
675 Smith St., Milwaukee, Wis.
Magnetic Mfg. Co.,
241 24th Ave., Milwaukee, Wis.

MAGNETS (Safety)
Dings Magnetic Separator Co.,
675 Smith St., Milwaukee, Wis.
Magnetic Mfg. Co.,
241 24th Ave., Milwaukee, Wis.

MANIFOLDS (Oxygen)
Oxweld Acetylene Co.,
Newark, N. J.

MATCH PLATES
Moltrup Steel Products Co.,
Beaver Falls, Pa.

MATCH PLATES (Aluminum)
U. S. Aluminum Match Plate Co.,
1269 W. 76th St., Cleveland, O.

METALLURGISTS
Kawin, Charles C., Co., 431 South Dearborn St., Chicago, Ill.

METALS (Nonferrous)
Ajax Metal Co., 46 Richmond St., Philadelphia, Pa.
Titanium Alloy Mfg. Co., The, Niagara Falls, N. Y.

MILLING ATTACHMENTS FOR PLANERS
Adams Co., The,
175 Foster St., Dubuque, Iowa.

MILLING STARS AND JACKS —See STARS (Tumbling Mill)

MILLS (Sand Mixing and Compounding)
Bartlett, C. O., & Snow Co.,
6201 Harvard Ave., Cleveland, O.
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.

MIXERS (Sand) — See SAND MIXING MACHINERY

MOLASSES (Foundry)
Mifflin Chemical Corp., Delaware Ave. and Tasker St., Philadelphia, Pa.

MOLD DRYERS
Young Brothers Co.,
6508 Mack Ave., Detroit, Mich.

MOLD OVENS
Foundry Equipment Co., 1831 Columbus Rd., Cleveland, O.
McCann-Harrison Corp.,
5005 Euclid Ave., Cleveland, O.
Marshall Blow Pipe Co.,
7431 Dubois St., Detroit, Mich.
Sly, W. W., Mfg. Co., The ,
4702 Train Ave., Cleveland, O.
Swartwout Co., The,
18511 Euclid Ave., Cleveland, O.
Young Brothers Co.,
6508 Mack Ave., Detroit, Mich.

MOLDING MACHINES
Adams Co., The,
175 Foster St., Dubuque, Iowa.
Arcade Mfg. Co., Dept. D,
Freeport, Ill.
Beardsley & Piper Co.,
2541 N. Keeler Ave., Chicago, Ill.
Demmler, Wm., & Brothers,
Kewanee, Ill.
Hanna Engineering Works,
1761 Elston Ave., Chicago, Ill.
Herman Pneumatic Machine Co.,
Union Bank Bldg.,
Pittsburgh, Pa.
International Molding Machine Co.,
2616 W. 16th St., Chicago, Ill.
Moline Iron Works, Moline, Ill.
Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

MOLDING MACHINES (Roll Over)
Adams Co., The, 175 Foster St., Dubuque, Iowa.
Arcade Mfg. Co., Dept. D,
Freeport, Ill.
Herman Pneumatic Machine Co.,
Union Bank Bldg.,
Pittsburgh, Pa.
International Molding Machine Co.,
2616 W. 16th St., Chicago, Ill.
Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

MOLDING MACHINES (Sand Throwing)
Beardsley & Piper Co., 2541 No. Keeler Ave., Chicago, Ill.

MOLDING MACHINES (Squeezer)
Adams Co., The,
175 Foster St., Dubuque, Iowa.
Arcade Mfg. Co., Dept. D,
Freeport, Ill.
Hanna Engineering Works,
1761 Elston Ave., Chicago, Ill.
International Molding Machine Co.,
2616 W. 16th St., Chicago, Ill.
Moline Iron Works, Moline, Ill.
Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

MONEL METAL
Driver-Harris Co., Harrison, N. J.
International Nickel Co.,
67 Wall St., New York City.
Williams & Company, Inc.,
901-37 Pennsylvania Ave.,
Pittsburgh, Pa.

MOTORS (Electric)
General Electric Co.,
Schenectady, N. Y.

NICKEL
American Mond Nickel Co.
Century Bldg., Pittsburgh, Pa.
International Nickel Co.,
67 Wall St., New York City.
Williams & Co., Inc., 901-37 Penn. Ave., Pittsburgh, Pa.

NICKEL (Alloys)
Niagara Falls Smelting & Refining Corp., 2204 Elmwood St.,
Buffalo, N. Y.

NITROGEN (Gas)
Linde Air Products Co.,
30 E. 42nd St., New York City.

NOZZLES (Sandblast)
American Foundry Equipment Co., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
Sly, W. W., Mfg. Co., The,
4702 Train Ave., Cleveland, O.

OIL (Core)—See CORE OIL

OIL BURNING INSTALLATIONS
Foundry Equipment Co., The,
1831 Columbus Rd., Cleveland, O
Hauck Mfg. Co.,
126 Tenth St., Brooklyn, N. Y.
McCann-Harrison Corp.,
5005 Euclid Ave., Cleveland, O

OVENS (Annealing)
McCann-Harrison Corp.,
5005 Euclid Ave., Cleveland, O.

OVENS (Core)—See CORE OVENS

OVENS (Enameling, Japanning, Etc.)
Foundry Equipment Co., 1831 Columbus Rd., Cleveland, O.
McCann-Harrison Corp.,
5005 Euclid Ave., Cleveland, O.
Marshall Blow Pipe Co.,
7431 Dubois St., Detroit, Mich.
Swartwout Co., The,
18511 Euclid Ave., Cleveland, O.
Young Brothers Co.,
6508 Mack Ave., Detroit, Mich.

OVENS (Mold)—See MOLD OVENS

OXY-ACETYLENE EQUIPMENT See WELDING AND CUTTING APPARATUS AND SUPPLIES (OxyAcetylene)

OXY-ACETYLENE WELDING AND CUTTING—See WELDING AND CUTTING APPARATUS AND SUPPLIES (Oxy-Acetylene)

OXYGEN AND HYDROGEN
International Oxygen Co.,
Newark, N. J.

OXYGEN IN CYLINDERS
Linde Air Products Co.,
30 E. 42nd St., New York City.

PACKING (Rubber Sheet)
Smooth-On Mfg. Co.,
572 Communipaw Ave.,
Jersey City, N. J.

PAINT (Graphite)
United States Graphite Co., The, Saginaw, Mich.

PANS (Grinding)—See GRINDING PANS (Sand)

PANS (Steel)
Truscon Steel Co., Youngstown, O.

PANS (Tempering)
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.
Phillips & McLaren Co., 24th and Smallman Sts., Pittsburgh, Pa.

PAPER (Abrasive)
Carborundum Co.,
Niagara Falls, N. Y.

PARTING COMPOUNDS
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

PATTERN COMPOUND
American Foundry Equipment Co., Mishawaka, Ind.
Menefee Foundry Co.,
Ft. Wayne, Ind.

PATTERN LETTERS
Chain Products Co.,
3924 Cooper Ave., Cleveland, O.

PATTERN LUMBER—See LUMBER (Pattern)

PATTERN PLATES (Aluminum)
U. S. Aluminum Match Plate Co.,
1269 W. 76th St., Cleveland, O.

PATTERN PLATES (Steel)
Moltrup Steel Products Co.,
Beaver Falls, Pa.
Truscon Steel Co., Youngstown, O.

PATTERNSHOP SUPPLIES AND EQUIPMENT
Diamond Clamp & Flask Co.,
Richmond, Ind.

PATTERN WAX
United Compound Co.,
228 Elk St., Buffalo, N. Y.

PATTERNS (Wood, Metal)
Arcade Mfg. Co., Dept. D,
Freeport, Ill.
Herman Pneumatic Machine Co.,
Union Bank Bldg.,
Pittsburgh, Pa.

PELLETS (Nickel)
American Mond Nickel Co.,
Century Bldg., Pittsburgh, Pa.

PINCH DOGS
Diamond Clamp & Flask Co.,
Richmond, Ind.

PIG IRON
Bethlehem Steel Co.,
Bethlehem, Pa.
Hanna, M. A., Co., The,
Leader Bldg., Cleveland, O.
Pilling & Co., Inc., 1500 Chestnut St., Philadelphia, Pa.

PLATES (Circular and Disc-Steel)
Moltrup Steel Products Co.,
Beaver Falls, Pa.

PLATES (Grinding Wheel-Steel)
Moltrup Steel Products Co.,
Beaver Falls, Pa.

PLATES (Rapping)
Diamond Clamp & Flask Co.,
Richmond, Ind.

PLATES (Snap Flask Bottom)
Diamond Clamp & Flask Co.,
Richmond, Ind.

PLATES (Steel Pattern)
Moltrup Steel Products Co.,
Beaver Falls, Pa.

PLUMBAGO
Dixon, Jos., Crucible Co.,
Jersey City, N. J.
McCormick, J. S., Co., 2428 Railroad St., Pittsburgh, Pa.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.
United States Graphite Co.,
Saginaw, Mich.

PLUMBING FIXTURES
Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.

PNEUMATIC TOOLS—See TOOLS (Pneumatic)

POLISHERS' AND PLATERS' SUPPLIES
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

POURING DEVICES
Arcade Mfg. Co.,
Dept. D, Freeport, Ill.
Modern Pouring Device Co.,
Port Washington, Wis.

POWDERED COAL PLANTS
Fuller Lehigh Co., Fullerton, Pa.

POWER SQUEEZERS — See SQUEEZERS (Hand and Power)

PREHEATING APPARATUS
Oxweld Acetylene Co.,
Newark, N. J.

PULLEYS (Magnetic)
Dings Magnetic Separator Co.,
675 Smith St., Milwaukee, Wis.
Magnetic Mfg. Co.,
241 24th Ave., Milwaukee, Wis.

Have the Sand Right And Do It Once

Permeability Control

1-2-3

Operations 1, 2 and 3 as described in our advertisement Nov. 15th gave Moisture Control by Water Meter and Moisture Indicator.

4

Attach the tube A containing the rammed sand sample onto permeability machine. Read A.F.A. Permeability direct on dial W. A tight sand will read in a low number as 12 while an open sand will read around 60.

5

The permeability of molds in the foundry is determined by using extension tube. Permeability of cores and dry sand is determined by baking the sand in tube A.

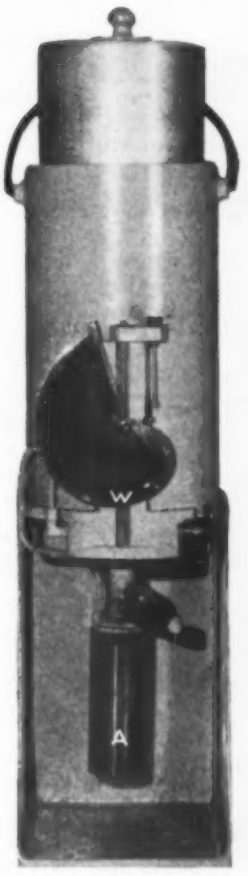
6

The Green and Dry Bond of the molding sand or cores is determined in Pounds by the Type C Sand Strength Machine.

Write for Particulars.

Harry W. Dietert

Box 1506 **Detroit, Michigan**



A. F. A. Permeability Machined Improved

FRANKLIN GAGGERS

Patented

Four times the grip of ordinary gaggers

MADE OF SQUARE TWISTED STEEL

SIZES: ⅛"-5/16"-⅜"-½"-⅝" READY FOR QUICK SHIPMENT

FRANKLIN CORE ROD & GAGGER CO., Franklin, Penna.

PATTERN LETTERS

THE CHAIN PRODUCTS CO., Cleveland, Ohio, U. S. A.

U. S. ALUMINUM MATCH PLATE CO.

1269 West 76th St. Cleveland, Ohio

Specializing in

CAST ALUMINUM MATCH PLATES
BRASS AND ALUMINUM PATTERN CASTINGS

Exclusively

WOOD CUTTING **"LENOX"** METAL CUTTING

BAND SAWS

"The Tools in the Plaid Box"

AMERICAN SAW & MFG. CO. SPRINGFIELD, MASS.

HACK SAWS - BAND SAWS - SCREW DRIVERS - GLASS CUTTERS

Approved by 200 Plants

This Core Machine Increases Production.

We build Core Machines to suit your conditions.

Gas Stove Burners.
Plumbing Goods.
Intricate Cores.

Correspondence Solicited

Wm. Demmler & Bros.

Kewanee, Ill.

WHERE TO BUY

PUMPS
Ingersoll-Rand Co.,
11 Broadway, New York City.

PUMPS (Air Lift)
Ingersoll-Rand Co.,
11 Broadway, New York City.
Sullivan Machinery Co., 122 S. Michigan Ave., Chicago, Ill.

PYROMETERS
Bristol Co., The,
Waterbury, Conn.
Pyrometer Instrument Co.,
74 Reade St., New York City.

PYROSCOPES
Shore Instrument & Mfg. Co., Inc., Van Wyck Ave. and Carll St., Jamaica, L. I., New York.

RAILWAY EQUIPMENT (Cars., Industrial, etc.)
Bethlehem Steel Co.,
Bethlehem, Pa.
General Electric Co.,
Schenectady, N. Y.

RAMMERS (Sand Pneumatic)—See SAND RAMMERS (Pneumatic)

RAMMERS (Sand Slinger)
Beardsley & Piper Co., 2541 N. Keeler Ave., Chicago, Ill.

RECLAIMERS (Sand)—See SAND RECLAIMERS

RECLAIMING (Iron and Sand)
Dings Magnetic Separator Co.,
675 Smith St., Milwaukee, Wis.

REFRACTORIES
Carborundum Co.,
Niagara Falls, N. Y.

REFRACTORIES (Special Shapes)
Lava Crucible Co. of Pittsburgh, Wabash Bldg., Pittsburgh, Pa.

REGULATORS (Compressed Air)
Oxweld Acetylene Co.,
Newark, N. J.

RESPIRATORS
Pulmosan Safety Equipment Corp., 386 Jay St., Brooklyn, N. Y.

RIDDLES
Beardsley & Piper Co., 2541 N. Keeler Ave., Chicago, Ill.
Malleable Iron Fittings Co.,
Branford, Conn.

RIDDLES (Pneumatic)
Adams Co., The,
175 Foster St., Dubuque, Iowa.

RIDDLES (Sand)
Foundry Supplies Mfg. Co.,
2221 Orchard St., Chicago, Ill.

RIVETERS — SEE HAMMERS (Chipping and Riveting—Pneumatic)

RODS (Iron and Steel)
Bethlehem Steel Co.,
Bethlehem, Pa.

RODS (Welding)—See WELDING RODS AND WIRE

ROSIN
Hercules Powder Co.,
Wilmington, Delaware.

SAND
Cape May Sand Co.,
Cape May, N. J.
Industrial Minerals Co.,
277 E. Long St., Columbus, O.
Ottawa Silica Co., Ottawa, Ill.
Portage Silica Co., 602 Stambaugh Bldg., Youngstown, O.
U. S. Silica Co., 122 South Michigan Ave., Chicago, Ill.

SAND (Core)
Cape May Sand Co.,
Cape May N. J.
Industrial Minerals Co.,
277 E. Long St., Columbus, O.
Ottawa Silica Co., Ottawa, Ill.
Portage Silica Co., 602 Stambaugh Bldg., Youngstown, O.
U. S. Silica Co., 122 S. Michigan Ave., Chicago, Ill.
Whitehead Brothers Co.,
537 W. 27th St., New York City

SAND (Molding)
Industrial Minerals Co.,
277 E. Long St., Columbus, O.
Keener Sand & Clay Co., 514 Hartman Bldg., Columbus, O.
Ottawa Silica Co., Ottawa, Ill.
Portage Silica Co., 602 Stambaugh Bldg., Youngstown, O.
U. S. Silica Co., 122 South Michigan Ave., Chicago, Ill.
Whitehead Brothers Co.,
537 W. 27th St., New York City.

SAND (Sandblast)
Cape May Sand Co.,
Cape May, N. J.
Industrial Minerals Co.,
277 E. Long St., Columbus, O.
Pangborn Corp., Hagerstown, Md.
Portage Silica Co.,
602 Stambaugh Bldg.,
Youngstown, O.
U. S. Silica Co., 122 South Michigan Ave., Chicago, Ill.
Whitehead Brothers Co.,
537 W. 27th St., New York City.

SAND (Silica)
Industrial Minerals Co.,
277 E. Long St., Columbus, O.
Ottawa Silica Co., Ottawa, Ill

SAND (Steel Molding)
Cape May Sand Co.,
Cape May, N. J.
Industrial Minerals Co.,
277 E. Long St., Columbus, O.
Ottawa Silica Co., Ottawa, Ill.
Portage Silica Co.,
602 Stambaugh Bldg.,
Youngstown, O.
U. S. Silica Co., 122 South Michigan Ave., Chicago, Ill.
Whitehead Brothers Co.,
537 W. 27th St., New York City.

SANDBLAST ABRASIVES
Industrial Minerals Co.,
277 E. Long St., Columbus, O.

SANDBLAST ABRASIVES (Steel Shot and Grit)
American Steel Abrasives Co.,
Galion, O.
Globe Steel Abrasive Co.,
Dept. F, Mansfield, O.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co.,
Pittsburgh, Pa.

SANDBLAST EQUIPMENT AND ACCESSORIES
American Foundry Equipment Co., Mishawaka, Ind.
Arcade Mfg. Co.,
Dept. D, Freeport, Ill.
Direct Separator Co., Inc.,
Syracuse, N. Y.
Koven, L. O., & Brother, Inc., 154 Ogden Ave., Jersey City, N. J.
Mott Sand Blast Mfg. Co.,
4611-21 Flournoy St.,
Chicago, Ill.
New Haven Sand Blast Co.,
New Haven, Conn.
Pangborn Corp., Hagerstown, Md.
Sly, W. W., Mfg. Co., The,
4702 Train Ave., Cleveland, O.

SANDBLAST NOZZLES — See NOZZLES (Sandblast)

SANDBLAST SHOT (Steel)—See SHOT (Steel Sand blast)

SANDBLAST TUMBLING BARRELS—See TUMBLING BARRELS

SAND CONDITIONING MACHINES
Axmann Sand-Throwing Machine Co., 1833 Columbus Rd., Cleveland, O.
Bartlett, C. O., & Snow Co.,
6201 Harvard Ave., Cleveland, O.
Production Equipment Co.,
5213 Windsor Ave., Cleveland, O.

SAND CONTROL MACHINES
Dietert, Harry W., 1275 Casgrain Ave., Detroit, Mich.

SAND CONVEYING AND HANDLING EQUIPMENT
Axmann Sand-Throwing Machine Co., 1833 Columbus Rd., Cleveland, O.
Bartlett, C. O., & Snow Co.,
6201 Harvard Ave., Cleveland, O.
Beardsley & Piper Co., 2541 N. Keeler Ave., Chicago, Ill.
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.
Standard Sand & Machine Co.,
5151 St. Clair Ave., Cleveland, O.

SAND CUTTING MACHINES
American Foundry Equipment Co., Mishawaka, Ind.
Production Equipment Co., 5213 Windsor Ave., Cleveland, O.

SAND DRYERS
Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.
McCann-Harrison Corp.,
5005 Euclid Ave., Cleveland, O.
Pangborn Corp., Hagerstown, Md.

SAND GRINDING PANS—See GRINDING PANS (Sand)

SAND MIXERS, CUTTERS AND SIFTERS
Beardsley & Piper Co., 2541 N. Keeler Ave., Chicago, Ill.

SAND MIXING MACHINERY
American Foundry Equipment Co., Mishawaka, Ind.
Axmann Sand-Throwing Machine Co., 1833 Columbus Rd., Cleveland, O.
McCormick, J. S., Co., 2428 Railroad St., Pittsburgh, Pa.
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.
Production Equipment Co., 5213 Windsor Ave., Cleveland, O.
Royer Foundry & Machine Co., Kingston Station, Wilkes-Barre, Pa.
Standard Sand & Machine Co.,
5151 St. Clair Ave., Cleveland, O.

SAND RAMMERS
Beardsley & Piper Co., 2541 N. Keeler Ave., Chicago, Ill.

SAND RAMMERS (Pneumatic)
Chicago Pneumatic Tool Co.,
6 E. 44th St., New York City.
Cleveland Pneumatic Tool Co.,
3734 E. 78th St., Cleveland, O.
Independent Pneumatic Tool Co.,
600 W. Jackson Blvd.,
Chicago, Ill.

SAND RECLAIMERS
Beardsley & Piper Co., 2541 N. Keeler Ave., Chicago, Ill.
Dings Magnetic Separator Co.,
675 Smith St., Milwaukee, Wis.
Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.

SAND SIFTERS AND SCREENING MACHINES
Adams Co., The,
175 Foster St., Dubuque, Iowa.
Arcade Mfg. Co., Dept. D,
Freeport, Ill.
Axmann Sand-Throwing Machine Co., 1833 Columbus Rd.,
Cleveland, O.
Beardsley & Piper Co., 2541 N. Keeler Ave., Chicago, Ill.
Hanna Engineering Works,
1761 Elston Ave., Chicago, Ill.
Herman Pneumatic Machine Co., Union Bank Bldg.,
Pittsburgh, Pa.
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.
Production Equipment Co., 5213 Windsor Ave., Cleveland, O.
Royer Foundry & Machine Co.,
Kingston Station,
Wilkes-Barre, Pa.
Standard Sand & Machine Co.,
5151 St. Clair Ave., Cleveland, O.

SANDSLINGERS
Beardsley & Piper Co., 2541 N. Keeler Ave., Chicago, Ill.

SAWS (Cold Inserted Tooth)
Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

SAWS (Cold Metal)
Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

SAWS (Hack)
American Saw & Mfg. Co.,
Springfield, Mass.

SAWS (Metal Band)
American Saw & Mfg. Co.,
Springfield, Mass.

SCALING HAMMERS
Ingersoll-Rand Co.,
11 Broadway, New York City.

SCLEROSCOPES
Shore Instrument & Mfg. Co., Inc., Van Wyck Ave. & Carll St., Jamaica, L. I., New York.

SCREENS (Sand)
Bartlett, C. O., & Snow Co.,
6201 Harvard Ave., Cleveland, O.
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.
Standard Sand & Machine Co., The
5151 St. Clair Ave., Cleveland, O.

SEACOAL
McCormick, J. S., Co., 2428 Railroad St., Pittsburgh, Pa.
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

SEPARATORS (Air Moisture)
Swartwout Co., The,
18511 Euclid Ave., Cleveland, O.

CAPE MAY SAND

"Profitable Quality"

The quality of Cape May Sand has proved profitable for hundreds of foundrymen. The service back of Cape May quality has won the confidence of users because of its promptness and efficiency.

We are always prepared to furnish an unlimited supply of undried or kiln dry grades of sand blast sands in five sizes, Nos. 0, 1, 2, 3 and 4. Double screened to uniform size. You can order direct or through our dealers.

Railroad connections on both the Pennsylvania and Philadelphia and Reading railroads.

Ask us for samples.

Cape May Sand Company

512 Washington Street

Cape May, N. J.

For STEEL MOLDING and SAND-BLASTING

PORTAGE SANDS

OVER 98% SILICA

The PORTAGE SILICA CO. Youngstown, Ohio

Sand and Fire Clay

Miners of Callia Red, Nickel Plate Sandusky, Core and Silica Molding Sands. Fire Brick and Fire Clay

The Keener Sand & Clay Co.

514 Hartman Bldg. Columbus, Ohio.

Metallurgy of Cast Iron

By Thomas D. West

The standard American work on gray iron foundry practice. It goes thoroughly into every phase of the subject—coke, pig iron, mixing by analysis, cupola operation, test, etc.

Price $4.00 (20s.) postpaid.

The Penton Publishing Co. 518IF

Penton Bldg., Lakeside Ave. & W. 3rd St. Cleveland, O.

CORNERED STEEL GLOBE GRIT Reg. U. S. Pat. Off.

Steel Blast Your Castings and SAVE MONEY

See our full page advertisement the first of each month — in The Foundry.

GLOBE H. C. CHILLED SHOT

GLOBE CORNERED STEEL GRIT

H.C. CHILLED GLOBE SHOT Reg. U. S. Pat. Off.

The Globe Steel Abrasive Co., Dept. F, Mansfield, O., U. S. A.

Whitehead's Foundry Sands

are laboratory controlled and foundry tested

We are amply equipped and prepared to furnish the proper sand for any variety of casting, having unexcelled resources and facilities. We are producers and shippers of Albany and North River Molding Sand, New Jersey Molding Sand, Lumberton Sand, Millville Gravel, Cattarugus Molding Sand, Windsor Lock Molding Sand, Strong and Sharp Silica Steel Molding Sand, Furnace Bottom Sand, Screened Jersey Fire Sand, Jersey Fire Clay, Kaolin and Cupola Daub, Core Sands and Blast Sands. Importers of French Sand.

We also carry in our various warehouses a complete line of foundry supplies.

WHITEHEAD BROTHERS COMPANY

Providence NEW YORK Buffalo

FOUNDRY SANDS, SUPPLIES AND EQUIPMENT

WHERE TO BUY

SEPARATORS (Air, Moisture, Oil)
Smith Monroe Co.,
223 South Main St.,
South Bend, Ind.

SEPARATORS (Magnetic)
Dings Magnetic Separator Co.,
675 Smith St., Milwaukee, Wis.

SEPARATORS (Magnetic and Electro Magnetic of all Kinds)
Dings Magnetic Separator Co.,
675 Smith St., Milwaukee, Wis.
Magnetic Mfg. Co., 241 24th Ave.,
Milwaukee, Wis.

SEPARATORS (Moisture-Oil)
Pangborn Corp., Hagerstown, Md.
Swartwout Co., The,
18511 Euclid Ave., Cleveland, O.

SEPARATORS (Sand)
Axmann Sand-Throwing Machine Co., 1833 Columbus Rd.,
Cleveland, O.
Dings Magnetic Separator Co.,
675 Smith St., Milwaukee, Wis.
Magnetic Mfg. Co.,
241 24th Ave., Milwaukee, Wis.
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.
Pangborn Corp., Hagerstown, Md.
Royer Foundry & Machine Co.,
Kingston Station,
Wilkes-Barre, Pa.
Sly, W. W., Mfg. Co., The,
4702 Train Ave., Cleveland, O.

SHEARS (Rod and Wire)
American Foundry Equipment Co.,
Mishawaka, Ind.

SHOT (Steel, Sandblast)
Pittsburgh Crushed Steel Co.,
Pittsburgh, Pa.
Steel Shot & Grit Co., 61st and A. V. Ry., Pittsburgh, Pa.

SHOT AND GRIT (Sandblast)
American Steel Abrasives Co.,
Galion, O.
Globe Steel Abrasive Co., Dept. F,
Mansfield, Ohio.
Pitsburgh Crushed Steel Co.,
Pittsburgh, Pa.

SILICA (Ground and Grits)
U. S. Silica Co., 122 South Michigan Ave., Chicago, Ill.

SLIP JACKETS (Steel)
Adams Co., The,
175 Foster St., Dubuque, Iowa.
Diamond Clamp & Flask Co.,
Richmond, Ind.

SNAP FLASK BOTTOM PLATES
—See PLATES (Bottom Snap Flask)

SNAP FLASK TRIMMINGS
Adams Co., The,
175 Foster St., Dubuque, Iowa.

SNAP FLASKS—See FLASKS

SNAP MOLD JACKETS—See JACKETS (Snap Flask and Mold)

SNAP STEEL TRIMMINGS
Diamond Clamp & Flask Co.,
Richmond, Ind.

SODA ASH
Mathieson Alkali Works, Inc.,
250 Park Ave., New York City.

SPIEGELEISEN
Bethlehem Steel Co., Bethlehem, Pa.

SPLIT PATTERN MACHINES
Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

SPRAY GUNS
Malleable Iron Fittings Co.,
Branford, Conn.

SPRUE CUTTERS
Adams Co., The,
175 Foster St., Dubuque, Iowa.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland, Ohio.

SPRUES (Spring)
Malleable Iron Fittings Co.,
Branford, Conn.

SQUEEZERS (Hand and Power)
Adams Co., The,
175 Foster St., Dubuque, Iowa.
Arcade Mfg. Co., Dept. D,
Freeport, Ill.
Moline Iron Works, Moline, Ill.
Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

STEAM TURBINE BLADES (Steel)
Moltrup Steel Products Co.,
Beaver Falls, Pa.

STEEL
Bethlehem Steel Co.,
Bethlehem, Pa.
Bourne-Fuller Co.,
1912 Scranton Rd., Cleveland, O.

STEEL (Alloy)
Timken Roller Bearing Co.,
Canton, O.

STEEL (Alloy, Cold Drawn)
Timken Roller Bearing Co.,
Canton, O.

STEEL (High Speed)
Bethlehem Steel Co.,
Bethlehem, Pa.

STEEL (Structural)
American Bridge Co., 71 Broadway,
New York City.
Bethlehem Steel Co.,
Bethlehem, Pa.
Penn Foundry & Mfg. Co.,
Reading, Pa.

STEEL BANDS
Adams Co., The,
175 Foster St., Dubuque, Iowa.
Diamond Clamp & Flask Co.,
Richmond, Ind.

STEEL BARGES
American Bridge Co., 71 Broadway,
New York City.

STEEL PRODUCTS (Cold Drawn)
Moltrup Steel Products Co.,
Beaver Falls, Pa.

STEEL SHOT
American Steel Abrasives Co.,
Galion, O.
Globe Steel Abrasive Co., The
Mansfield, O.
Pittsburgh Crushed Steel Co.,
Pittsburgh, Pa.

STEEL TOWERS
American Bridge Co., 71 Broadway,
New York City.

STONE (Oil)
Carborundum Co.,
Niagara Falls, N. Y.

TALC
Stevens, Frederic B., Inc., Larned and Third Sts., Detroit, Mich.

TITANIUM
Titanium Alloy Mfg. Co.,
Niagara Falls, N. Y.

TONGS (Crucible)
Fisher, Alfred, Furnace Co.,
803 W. Madison St., Chicago, Ill.

TONGS (Shake Out)
Diamond Clamp & Flask Co.,
Richmond, Ind.

TOOL GRINDERS
Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

TOOLS (Electric Portable)
Independent Pneumatic Tool Co.,
600 W. Jackson Blvd.,
Chicago, Ill.

TOOLS (Pneumatic)
Chicago Pneumatic Tool Co.,
6 E. 44th St., New York City.
Cleveland Pneumatic Tool Co.,
3734 E. 78th St., Cleveland, O.
Independent Pneumatic Tool Co.,
600 W. Jackson Blvd.,
Chicago, Ill.
Ingersoll-Rand Co.,
11 Broadway, New York City.

TORCHES AND BURNERS (Acetylene, Blow, Oxy-Acetylene)
Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.
Oxweld Acetylene Co.,
Newark, N. J.

TRACK AND RAIL SUPPLIES
Bethlehem Steel Co.,
Bethlehem, Pa.

TRIPOLI
American Tripoli Co., Seneca, Mo.

TROLLEYS
Curtis Pneumatic Machinery Co.,
1573 Kienlen Ave., St. Louis, Mo.

TRUCKS (Annealing Oven)
American Foundry Equipment Co.,
Mishawaka, Ind.

TRUCKS (Industrial)
Penn Foundry & Mfg. Co.,
Reading, Pa.

TRUCKS (Welding)
Oxweld Acetylene Co.,
Newark, N. J.

TUBES
Timken Roller Bearing Co.,
Canton, O.

TUBES (Cold Drawn Seamless Steel)
Timken Roller Bearing Co.,
Canton, O.

TUBING
Williams & Company, Inc., 901-37 Pennsylvania Ave., Pittsburgh, Pa.

TUMBLING BARRELS
Arcade Mfg. Co.,
Dept. D, Freeport, Ill.
Koven, L. O., & Brother, Inc.,
154 Ogden Ave.,
Jersey City, N. J.
New Haven Sand Blast Co.,
New Haven, Conn.
Pangborn Corp., Hagerstown, Md.
Scully-Jones & Co.,
2012 W. 13th St., Chicago, Ill.
Sly, W. W., Mfg. Co.,
4702 Train Ave., Cleveland, O.

TURBO BLOWERS—See BLOWERS

TURNTABLES
Beardsley & Piper Co., 2541 N. Keeler Ave., Chicago, Ill.

VALVES
Westinghouse Traction Brake Co.,
Wilmerding, Pa.

VALVES (Air)
Jenkins Bros.,
80 White St., New York City.

VALVES (Back Pressure)
Oxweld Acetylene Co.,
Newark, N. J.

VALVES (Foot and Knee)
Malleable Iron Fittings Co.,
Branford, Conn.

VALVES (Gas, Water and Steam)
Jenkins Bros.,
80 White St., New York City.

VALVES (Pneumatic)
Cleveland Pneumatic Tool Co., The,
3734 E. 78th St., Cleveland, O.

VARNISH CANS (For Pattern Shops)
Diamond Clamp & Flask Co.,
Richmond, Ind.

VENTILATING SYSTEMS
McCann-Harrison Corp.,
5005 Euclid Ave., Cleveland, O.
Swartwout Co., The,
18511 Euclid Ave., Cleveland, O.

VIBRATORS
Adams Co., The,
175 Foster St., Dubuque, Iowa.
Arcade Mfg. Co., Dept. D,
Freeport, Ill.
Hanna Engineering Works,
1761 Elston Ave., Chicago, Ill.
Malleable Iron Fittings Co.,
Branford, Conn.
Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa.

VIBRATORS (Electric)
Foundry Supplies Mfg. Co., 2221 Orchard St., Chicago, Ill.

WAX (Core, Wire, Pattern, Vent)
American Vent Wax Co., 64 Market St., Lockport, N. Y.
McCormick, J. S., Co., 2428 Railroad St., Pittsburgh, Pa.
United Compound Co.,
228 Elk St., Buffalo, N. Y.

WEDGES (Foundry)
Diamond Clamp & Flask Co.,
Richmond, Ind.

WELDING (Gas)
Prest-O-Lite Co., Inc.,
30 E. 42nd St., New York City.

WELDING AND CUTTING APPARATUS AND SUPPLIES (Oxy-Acetylene)
Imperial Brass Mfg. Co.,
1200 W. Harrison St.,
Chicago, Ill.
Oxweld Acetylene Co.,
Newark, N. J.
Williams & Company, Inc., 901-37 Pennsylvania Ave., Pittsburgh, Pa.

WELDING AND CUTTING EQUIPMENT (Electric Arc)
General Electric Co.,
Schenectady, N. Y.
Williams & Company, Inc., 901-37 Pennsylvania Ave., Pittsburgh, Pa.

WELDING FLUXES
Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.
Oxweld Acetylene Co.,
Newark, N. J.

WELDING RODS AND WIRE
Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.
Oxweld Acetylene Co.,
Newark, N. J.
Williams & Company, Inc.,
901-37 Pennsylvania Ave.,
Pittsburgh, Pa.

WHEELS (Grinding)—See ABRASIVE WHEELS

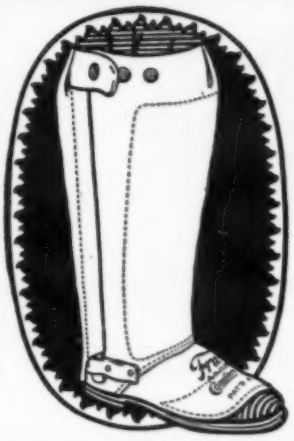
WINCHES
Sprague Electric Hoist Division of Shepard Electric Crane & Hoist Co., 30 Church St., New York City.

WIRE (Welding)—See WELDING RODS AND WIRE

WIRE AND CABLE (Electric)
General Electric Co.,
Schenectady, N. Y.

WIRE CUTTING AND STRAIGHTENING MACHINES
American Foundry Equipment Co.,
Mishawaka, Ind.

WOOD PRESERVATIVES
Lindsay-McMillan Co.,
930 South Water St.,
Milwaukee, Wis.



Frank Adjustable Comfort Legging

New Features—Large flare protects instep and foot. Adjustable so one size fits any leg. Comfortable, no springs or steel to tire legs. On quickly—off instantaneously.

Three styles—hip, knee or spats in chrome leather, asbestos or duck.

100% PROTECTION

Men like to wear them because they are comfortable. Safety men recommend them because they are safe. Purchasing agents find them economical.

Write for Sample Order and Catalog.

Manufacturers of Asbestos, Leather ,and Fireproofed Duck Clothing, Gloves, Aprons, Helmets, Etc.

SAFETY CLOTHING COMPANY

3800 PAYNE AVE. CLEVELAND, O.

One Ton (2000 Lbs.)

of American Steel Abrasives will do more cleaning, Quicker and Better, than a Carload of sand

Without changing your present sand-blast equipment you can switch to American Steel Abrasives and save fifty per cent in your cleaning costs. Others are doing it. We will be glad to demonstrate.

THE AMERICAN STEEL ABRASIVES CO.
604 Sherman St. Galion, Ohio

The Only Independent Steel Abrasive Manufacturer in America

Marshall

Section built METAL OVENS

Built to meet individual requirements.

THE ONLY OVEN BUILT EMBODYING ALL THESE IMPORTANT ADVANTAGES.

Continuous, uninterrupted insulation and elimination of metal contact at the joints without sacrificing rigidness or structural strength. THIS FEATURE IS FOUND ONLY IN MARSHALL SECTION BUILT METAL OVENS.

Low installation cost, can be erected without expensive help; greatly reduced maintenance, as inspection and repairs are possible without damage or shut down.

Can be easily disassembled and quickly moved about to meet new conditions.

IN A RECONSTRUCTION PROGRAM THE SALVAGE IS 100%.

New sections may be added at any time to lengthen or widen them as required to provide for increased production.

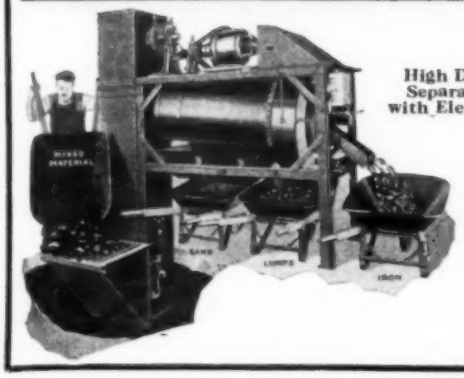
Any medium of heat may be used, such as coke—gas—oil—steam and electricity.

Any system of transportation through the ovens may be employed—car—trolley—truck or conveyor.

Marshall Blow Pipe Co.

7433 Dubois. DETROIT Michigan

$.75 to $1.20 ON EVERY TON



High Duty Separator with Elevator.

That's an average of what goes to the "dump" in shot, spillings, pieces of gates, sprues, core wires, nails, etc. Save it with High Duty Magnetic Separators. Reclaim every bit of valuable iron quickly and without laborious hand-picking.

High Duty Separators are simple to operate (entirely one man) and are of sturdy *all steel* construction. No make and break currents, commutator devices, sliding contacts or slip rings. Wiring protected by armored conduit. Three separations: iron, sand and slag. More than pays for itself in savings.

Built in several types for various services and capacities. Write for bulletins and complete data.

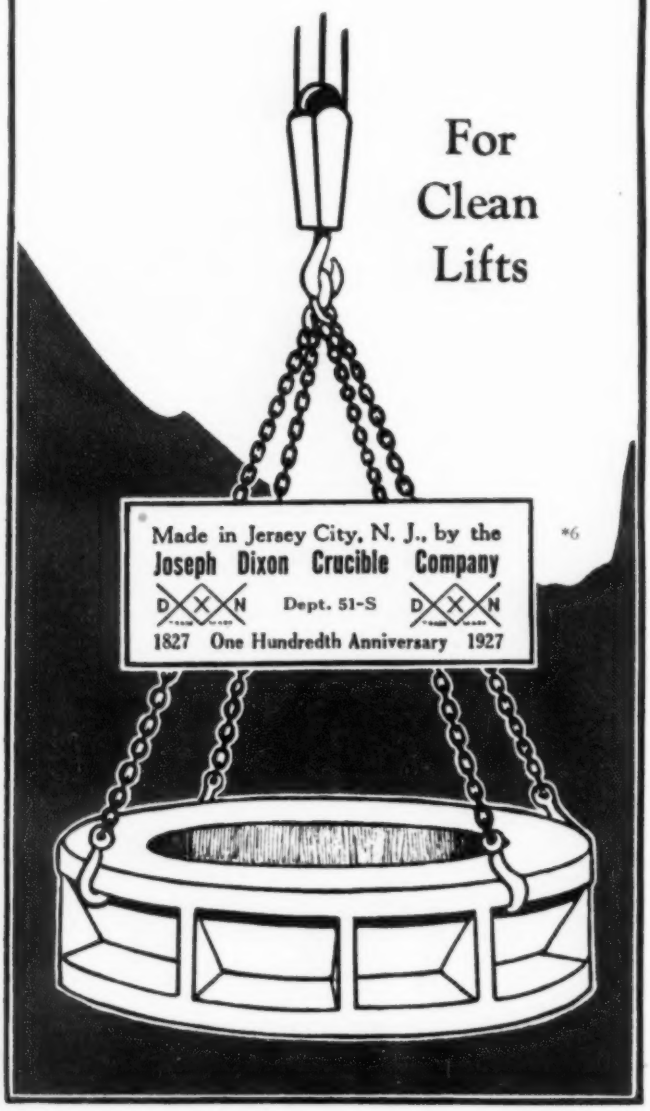
MAGNETIC MANUFACTURING COMPANY

278 23rd Avenue Milwaukee, Wisconsin

Dixon's Graphite Facings

Dixon's Graphite facings are easily applied—they "slick" well—and by insuring clean lifts, reduce cleaning and machining costs.

There is a Dixon grade to suit every class of work and meet every foundry use. Tell us your shop conditions and we'll gladly send you samples. *The results will surprise you!*


For Clean Lifts
Made in Jersey City, N. J., by the
Joseph Dixon Crucible Company
D X N Dept. 51-S D X N
1827 One Hundredth Anniversary 1927
*6

CORE-MOL
A MOLASSES BINDER

The Binder Without a Single Fault

Only one binder measures up to that description—Core-Mol, the better molasses binder!

There's nothing in Core-Mol to cause gases, pinholes, or any of the other troubles which follow the use of other kinds of binders.

We'll be glad to give you the names of leading foundrymen who are using Core-Mol—the safe, economical and dependable molasses binder.

Prices on request.
Send for a trial barrel.

MIFFLIN CHEMICAL CORPORATION
Philadelphia, Pa.
New York Warehouse:
527 Hudson Street

BUFFALO BRAND
VENT WAX

FOR THOROUGH CORE VENTING

Order from your supply house or write us direct. Always look for the "Buffalo" on the octagon carboard spool.

UNITED COMPOUND CO.
228 Elk St., Buffalo, N. Y.

AMERICAN BRAND VENT WAX

FOR DEPENDABLE VENTING YOU CAN RELY ON AMERICAN BRAND VENT WAX

If your Supply House can not Supply You—Order Direct.

AMERICAN VENT WAX CO.
64 Market St. Lockport, N. Y.

AMERICAN TRIPOLI COMPANY

(Incorporated 1892)

Subsidiary of Barnsdall Corporation

SENECA, MISSOURI, U. S. A.

Cable Address: "Tripoli, Seneca"

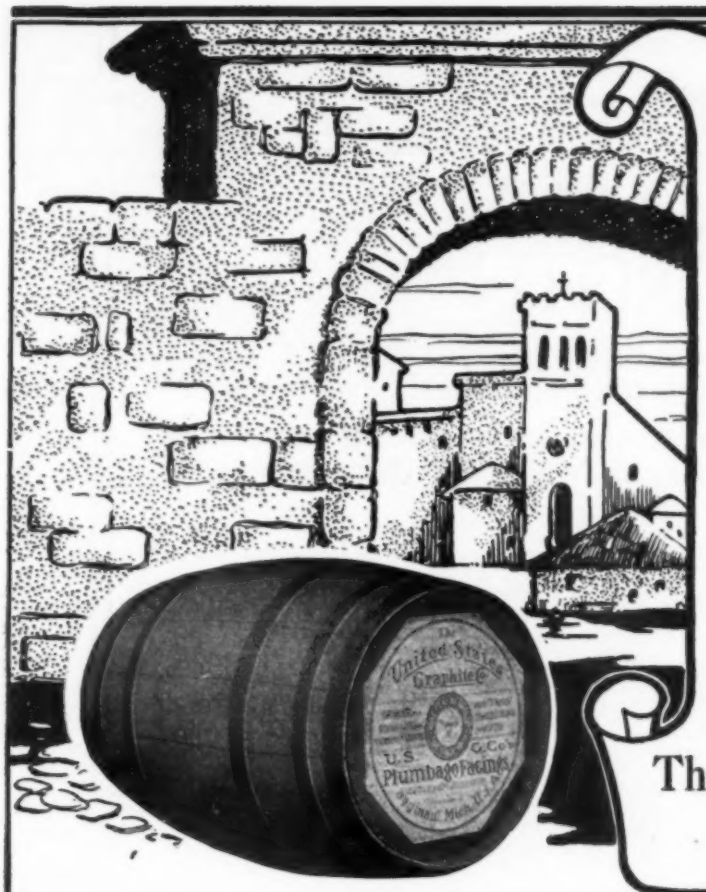
SENECA STANDARD

Reg. U.S.Pat. Off.
Seneca Standard Tripoli

Codes: A B C 5th & 6th:
Marconi: Bedford McNeil

B

Reg. U.S.Pat. Off.
"Be Square" Products



Mexican Plumbago

is the gateway to clean smooth castings, regardless of how hot you pour your iron. It is *truly economical* because it cuts to a minimum the profit-consuming operations in the cleaning room — chipping, sand-blasting and grinding.

Let us send you a quantity—gratis—for testing purposes.

The United States Graphite Co.
Saginaw, Mich.
New York — Philadelphia — Pittsburgh
Chicago — St. Louis — San Francisco

* 4

PENNSYLVANIA AIR COMPRESSORS

have so earned the confidence of their users that new orders from old customers form a generous part of the Company's business.

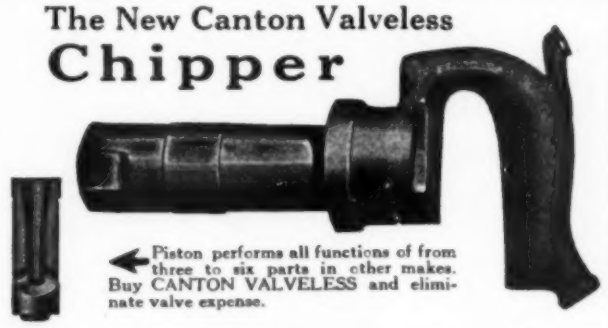
PENNSYLVANIA PUMP & COMPRESSOR CO.
Main Office and Works, Easton, Pa.

BURY AIR AND GAS COMPRESSORS VACUUM PUMPS

ALL SIZES, ALL TYPES, ALL PRESSURES TO MEET ANY ENGINEERING REQUIREMENTS

BURY COMPRESSOR CO., 1746 Cascade St. ERIE, PA.

The New Canton Valveless
Chipper



← Piston performs all functions of from three to six parts in other makes. Buy CANTON VALVELESS and eliminate valve expense.

Canton Pneumatic Co.
Canton, Ohio

"CLECO"
THE NEW HIGH SPEED CHIPPER FASTEST LIGHTEST AND EASIEST HOLDING HAMMER MADE

IDEAL FOR CLEANING CASTINGS

STYLE A. K.

STYLE "L"

Write for Bulletin No. 727

Branch Offices in all the larger cities
THE CLEVELAND PNEUMATIC TOOL CO.
3734 E. 78th St., Cleveland, O., U. S. A.

CORES TESTED FOR TENSILE STRENGTH

Tests show that Hercules Wood Rosin in both dry and liquid core-binders makes cores of high tensile strength.

Hercules Wood Rosin is clean and uniform, because it is scientifically produced in modern plants under the supervision of skilled chemists.

Write for specifications and prices.

HERCULES POWDER COMPANY
(INCORPORATED)
935 Market Street, Wilmington, Delaware

SALES OFFICES:

Allentown, Pa.	Chattanooga	Duluth	Joplin, Mo.	New York City	Pittsburgh	Salt Lake City
Birmingham	Chicago	Hazleton, Pa.	Los Angeles	Norristown, Pa.	Pottsville, Pa.	San Francisco
Buffalo	Denver	Huntington, W. Va.	Louisville	Pittsburg, Kan.	St. Louis	Wilkes-Barre

6

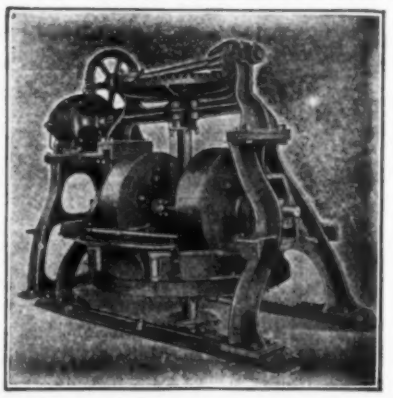
CUPOLA BLOCKS
all kinds of Fire Brick, Silica Brick, Cements
U. S. REFRACTORIES CORPORATION
MOUNT UNION, PA.
Pittsburgh Office: *Oliver Building* *2

Queen's Run Fire Brick
CUPOLA BLOCKS
Any Style Any Quantity
MAY WE SERVE YOU? Queen's Run Refractories Co. Inc.
Lock Haven, Pa.

MOTT SAND BLAST MFG. CO., INC.
Sand Blast Equipment and Accessories
General Office and Works
4611-4621 Flournoy St., Chicago, Ill.
Eastern Sales Office
17 John Street, New York City

Sand Blast Helmets That Protect
Pulmosan Sand Blast
Helmets
Made in Canvas & Leather Glass or Wire Screen Fronts
With or Without Air Connection, Stationary or Removable Fronts.
Pulmosan
Safety Equipment Corp.
386 Jay St. Brooklyn, N. Y.

PHILLIPS & McLAREN CO.
We manufacture
Grinding Pans
of all types and sizes for Steel, Gray Iron and Malleable Foundries
24th and Smallman Sts., Pittsburgh, Pa.



Motor End Spencer
Turbo-Compressors

The Right Air Supply Constantly at your Command.

Easy, convenient regulation of both volume and pressure, give the operator of Spencer Turbo-Compressors absolute control over the air supply—which results in *high grade castings throughout the entire cupola run.*

Spencer Turbo-Compressors are quality-built. This, together with the fact that they are remarkably simple, reliable, low in maintenance cost and free from pulsations or surging, assure you a very profitable investment. Write for Bulletins.

The Spencer Turbine Co.
Hartford, Conn.

Spencer Turbo-Compressors
An Important Factor In Economical Melting

Cyclone Suction Sand Blast Nozzles for cleaning Gray Iron, Steel and Brass Castings.

Simple Inexpensive in cost and operation

Simple Inexpensive in cost and operation

Direct Separator Co.
Syracuse, N. Y.

DUSTLESS SELF-CONTAINED HOEVEL SANDBLAST AUTOMATIC MACHINES

We manufacture All Types of Equipment
also Tanks, Sheet Steel Pipe,
Stacks, Vats, Sinks and
Special Plate Steel Work

L. O. Koven & Brother, Inc.
154 Ogden Ave. Jersey City, N. J.

Hoisting the Standard of Furnace Lining Life

Many users of nonferrous, crucible and open flame furnaces have cut their furnace lining maintenance cost deeply by using LAVARAM (the super-refractory material) instead of built up brick structure.

A LAVARAM lining has unusually high temperature resistance; there are no joints to burn out, and positively no slagging.

Furnished loose mixed in barrels ready for immediate use. No expensive stocks of shapes to carry.

LAVARAM
Super-Refractory Material

—o—

Lava Crucible Co. of Pittsburgh
Dept. F Pittsburgh

Manufacturers of
Lava Crucibles—Lavaram—Lavapatch—Lavabond—Lava Furnace Covers—Lava Base Blocks—Lava Shape Lining for all nonferrous melting units.

A Dust Arrester That *Lasts!*

The Morse Rarefied Dust Collector is of all-metal construction, and extreme durability. There are no moving parts, and no cloth or screens to clog up or cut through. There is no cutting out of the fan, since the Collector is placed between the fan and the source of dust.

The Morse Rarefied Dust Collector has filled the need for an efficient reliable means of providing clean air for *over twenty years.*

Our engineering staff will be glad to analyze your conditions and suggest a solution for them. Write for full details.

MORSE RAREFIED DUST COLLECTOR

The Knickerbocker Company

516 Liberty Street

Jackson, Michigan

HYTEMPITE

(Reg. U. S. Pat. Off.)

"The Standard for Comparison in High Temperature Cements"

Bonds firebrick and makes the joint as strong as the brick itself. The strong thin HYTEMPITE joint resists erosion, prevents spalling and increases life of furnace linings.

For quick patches, repairs and rebuilding furnace walls the Quigley Gun shoots refractory mixtures at any place on walls or arches.

Stock and Service in Every Industrial Center

QUIGLEY FURNACE SPECIALTIES CO., Inc.

26 Cortlandt St., New York City *3

HAUCK TRADE MARK OIL BURNERS for

Cupola lighting **Mold drying**
Ladle heating **Core Ovens**

Write us about your foundry heating problems. Our experience is at your service without obligation.

Hauck Manufacturing Company

131 Tenth Street **Established 1900** **Brooklyn, N. Y.**

ROSS-TACONY CRUCIBLES

Specify ***Ross-Tacony Crucibles*** once—and you will keep on doing it! For over 50 years they have been regarded as the standard of quality.

Ross-Tacony Crucible Co.

Established 1871 **Tacony, Philadelphia, Pa.**

Foundry Moulding Machine and Pattern Equipment

by Edwin S. Carman

225 Pages, 6" x 9" **Illustrated**

THIS book tells all about foundry moulding machines and the equipment necessary for their use. There are many valuable illustrations with drawings to illustrate the method of mounting patterns and making the moulds by machine power. All the different types of moulding machines are explained together with the pattern and flask equipment necessary for their use in such a way that the reader will obtain a knowledge in regard to machine moulding that will be of value to him in any line of engineering work in the foundry. The practical foundryman will have light shed on the most important question "WILL IT BE PROFITABLE TO RUN THIS JOB ON A MOULDING MACHINE, AND IF SO, ON WHAT TYPE OF MACHINE?"

Price $5.00, (25s.) Postpaid

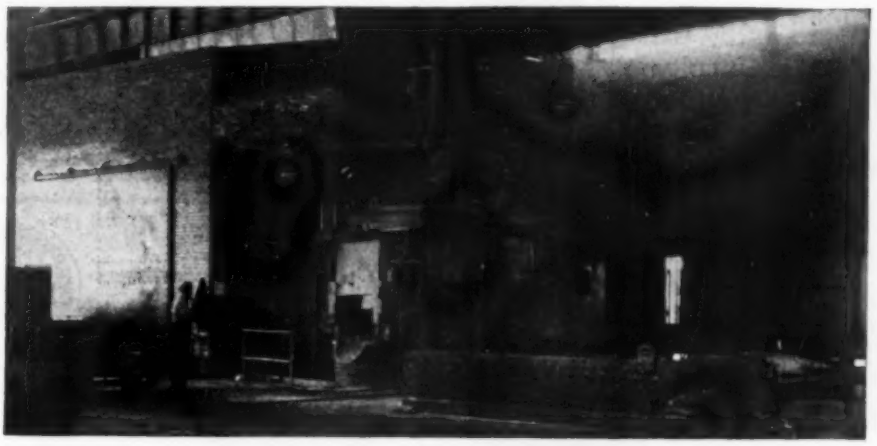
THE PENTON PUBLISHING COMPANY **Book Department**

Penton Bldg., Lakeside Ave. & West 3rd St. **Cleveland, O.**

538 I F

HEROULT ELECTRIC FURNACES

For Alloy and High-Grade Steels and Castings
One-Half Ton to Forty Tons Capacities.



7 ton Heroult Electric Furnace

AMERICAN BRIDGE COMPANY

71 Broadway, New York
Offices in Principal Cities

Swindell FURNACES

FOUNDRY for SERVICE

OPEN HEARTH MELTING FURNACES FOR STEEL AND MALLEABLE CASTINGS

AIR FURNACES
For Grey Iron and Malleable

ANNEALING FURNACES
For Steel and Malleable Castings

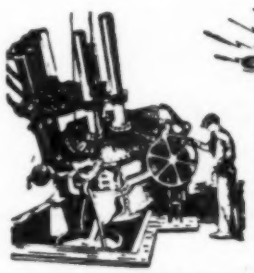
ELECTRIC FURNACES
For Melting and Annealing

CORE OVENS

MOLD DRYING OVENS

Wm. Swindell and Brothers
PITTSBURGH, PA.

Moore Rapid



Lectromelt Furnaces

stand supreme for economical production of Tool Steels, Alloy Steels, Steel Castings, Gray and Malleable Iron. Basic and Acid Operation.

Ask 'Lectromelt Users.

Pittsburgh Electric Furnace Corp.
P. O. Box 1125 Pittsburgh, Pa.
Electric Furnaces—Good Furnaces Only

Attention

Brass and Aluminum Foundrymen

For better and cheaper castings.

Equip your foundry with the well known and reliable Alfred Fisher furnaces and equipment.

We manufacture and carry in stock a full line of fuel oil and gas fired, brass, bronze and aluminum crucible furnaces, kettle furnaces, core ovens, oil pumps, forges, and special tongs, also motors, blowers, special fire brick linings, and are the sole distributors of our well known KARMIX furnace cement.

Alfred Fisher Furnace Company

803 W. Madison St., Chicago, Ill.
Established 1906 *Not Inc.*

Hanna Pig Iron from Lake Superior Iron Ore

THE M. A. HANNA CO.

OUR furnaces located at Buffalo, N. Y., Detroit, Mich., Leetonia and Dover Ohio, and West Middlesex, Pa., are wholly engaged in the manufacture of high grade Merchant Pig Iron to meet the most exacting needs of consumers in any part of the country.

Brands:
"BUFFALO" "DETROIT"
"CHERRY VALLEY" "DOVER"
"FANNIE" "NELLIE"

Foundry Malleable Basic Bessemer

The M. A. HANNA Co.
Cleveland

Pig Iron Sales Offices:
BUFFALO
DETROIT
CINCINNATI
PITTSBURGH
SPRINGFIELD, MASS.
TORONTO

HANNA PIG IRON IRON ORE COAL

Insure Your Castings with Boronic Alloys

Boronic Alloys have now been used for years —Continuous use by the same foundries.
Their use make Clean Dense Castings a certainty.
We will furnish the proof if you furnish the opportunity.

There is a Special Boronic Alloy for Every Purpose

American Boron Products Co., Inc.
Ramsdell and Elmwood Aves., Buffalo, N. Y.

MOND NICKEL PELLETS

For use in the production of Nickel Steel, Nickel Cast-Iron, Nickel Silver, Copper Nickel and other Alloys.

Send for Descriptive Booklet

AMERICAN MOND NICKEL COMPANY
Century Building Pittsburgh, Pa.

1

Foundrymen's Handbook

309 Pages, 6 x 9 Inches *Price $5.00 Postpaid (£1. 10s. 6d.) Net*

Table of Contents

Section I.	General Foundry Data	Section IV.	Nonferrous Metals and Alloys
Section II.	Computing Weights	Section V.	Specifications
Section III.	References for Pattern Makers	Section VI.	Miscellaneous Tables

THE FOUNDRY'S famous "Data Sheets" have been compiled and put into book form with much additional information — thus furnishing foundrymen with a reference work by the use of which they can successfully solve any ordinary problem arising in foundry operations. It is a complete compendium and handbook covering every branch of foundry work from estimating the price to cleaning the finished casting.

Price, Postpaid { $5.00 in United States and Canada / 25s. in all other Countries

The Penton Publishing Co.
Book Department
Penton Bldg., W. 3rd. St. & Lakeside Ave., Cleveland, O.

3081P

Fluor Spar For Foundries

Send for information

Hillside Fluor Spar Mines
1211 First National Bank Bldg., Chicago
Warehouse stocks, Chicago, Cleveland, St. Louis. Mine—Rosiclare, Ill.

FOUNDRY MANGANESE CO.

Ferro Manganese.....80%
Ferro Silicon.....50%
Ferro Chrome
GROUND TO ALL SIZES

Works CONSHOHOCKEN, PA.
Office 200 Harrison Bldg. Philadelphia

Hillman Coal & Coke Co.

STANDARD CONNELLSVILLE LOW SULPHUR
FOUNDRY COKE
First National Bank Bldg., PITTSBURGH, PA.

Pilling & Company, Inc.

Pig Iron, Coke & Alloys

Philadelphia	New York	Boston	Pittsburgh
1500 Chestnut St.	11 Broadway	80 Federal St.	Oliver Bldg.

Reduce Melting Time and Speed Production

Intermediate alloys reduce melting time and Speed Up Production. Their use is the correct metallurgical method for introduction of high melting point metals into alloys. The final alloy is homogenous and has the highest physical properties.

Foundries all over the country are getting especially good results from using Falls Brand

50-50 Nickel Copper
50-50 Silicon Aluminum
50-50 Copper Aluminum
20-80 Nickel Aluminum
25-75 Manganese Aluminum

Niagara Falls Smelting and Refining Corp.
2208 Elmwood Ave. Buffalo, N. Y.

ALLOYS AND PRODUCTS, INC.

Makers of the

"ALPRO"

Line of Quality Alloys

Specialists in Alloys of:

Nickel	Copper	Aluminum
Chromium	Manganese	Magnesium
Iron	Zinc	Silicon

And all types of Special and Technical Alloys made to Specifications.

We specialize in making:

Densifiers	Rich Alloys
Fluidizers	Stabilizers
Deoxidizers	Desulphurizers
Degasifiers	Hardeners

Oak Point Avenue & Barry Street
Bronx, New York City

NICKEL

AND

FERRO-CHROMIUM

Warehouse Stocks—Quick Delivery
Williams & Company, Inc.
901-937 Pennsylvania Ave.
CLEVELAND **PITTSBURGH** CINCINNATI

EVERBRITE® *Casting Metal*

The Nickel Copper Alloy with unequalled casting properties, possessing exceptional strength and resistance to corrosion and erosion of steam at high pressures.

Send for Descriptive Booklet

AMERICAN MOND NICKEL COMPANY
CENTURY BUILDING · PITTSBURGH, PA.

YOU WILL BE INTERESTED

in our thirty-two page illustrated booklet dealing with Aluminium Alloys, Mixing, Melting and Casting.

Write us for "Light Alloys in the Foundry".

THE BRITISH
ALUMINIUM
COMPANY LTD.
165 Broadway New York
380 Adelaide St. W. Toronto

Chemists **Kawin Service** Practical Foundry Advisors

Twenty-four Years of Proven Satisfactory Service

As applied to *Analysis and Foundry Problems*

Reliable Chemists . . . . . Practical Foundrymen

Dependable Analysis, Improved Quality of Castings, Reduction of Cost

Charles C. Kawin Company

General Offices:—431 S. Dearborn Street, Chicago.

Chicago Buffalo Cincinnati San Francisco

"BUILT BY HOLCROFT & COMPANY"

has important significance to every factory executive to whose installation it applies.

Furnaces—Ovens

Electric
Oil
Gas
Coal

Holcroft & Co.

6545 Epworth Blvd. Detroit, Mich

CHARLES VICKERS

60 South Elmwood
BUFFALO, N. Y.

Consulting Brass Foundry Specialist

Brass Foundry Surveys Made and Advisory Reports Presented Regarding Layouts, Operating Methods, Castings Losses, Melting and Ventilation Problems.

Metal Mixtures Reviewed to Determine if Cheaper Alloys can be Substituted.

Electric Oil Gas

ANNEALING FURNACES

OIL and GAS BURNING EQUIPMENT

GEORGE J. HAGAN COMPANY

Chamber of Commerce Building, Pittsburgh, Pa.

Furnace and Combustion Engineers

Detroit San Francisco Chicago

Fuller Lehigh Company

Designers and builders of Pulverized Coal Equipment as applied to steam power plants, metallurgical furnaces, kilns and driers.

Fuller Lehigh Co.

Fullerton, Penna.

A Babcock & Wilcox Organization

REFINING METALS ELECTRICALLY—*By Larry J. Barton*

The first book published to dea essentially with the foundry angle of electric furnace practice. Comprehensive, thorough, up-to-date and written for operators, managers, and executives of electrically equipped foundries.

Price $6.00 (30s.) Postpaid

THE PENTON PUBLISHING CO. (*Book Dept.*)

Penton Bldg., W. 3rd St. & Lakeside Ave. CLEVELAND, O. 535IF

PRACTICAL ALLOYING

By J. F. BUCHANAN

The most comprehensive and thorough treatise on alloying that has yet been published. The author is a practical man of many years' experience and has written this book with a view of meeting the every-day needs of the foundryman.

CONTENTS

Metal Refining, Ancient and Modern
The Properties of Alloys
History and Peculiarities of Alloys
Some Difficulties of Alloying
Gates and Risers, Alloys
Methods of Making Alloys
Color of Alloys
The Notation of Alloys
Standard Alloys
Foundry Mixtures
White Metals
Solders, Novelty Metals, Etc.
Fluxes, Alloys
About Crucibles, Tables

The tables alone are worth many times the price of the book.

205 Pages, 41 Illustrations.

Price $5.00 (25s.), Postpaid

THE PENTON PUBLISHING CO.

Book Department

Penton Bldg., Lakeside Ave. & West 3rd St. Cleveland, O. 324 I F

Classified Ads

RATES

Help Wanted Advertisements
6c per word—minimum advertisement—$3.00

Position Wanted Advertisements
5c per word—minimum advertisement—$1.50

For Sale and Miscellaneous Advertisements
10c per word—minimum advertisement—$3.00

IMPORTANT

Six words must be added for box address.

Publication Dates: First and Fifteenth of the month. To insure insertion, copy must reach us twelve days before date of publication. Please have your remittance accompany advertisement.

Help and Position Wanted advertisements should state whether—Gray Iron, Steel, Malleable or Brass.

Help Wanted

A LARGE NEW JERSEY CONCERN HAS a position open for an experienced man who can install and set up and take charge of a brass pipe fitting testing department. A very good opportunity for right man. Address Box 753, THE FOUNDRY, Cleveland.

WORKING FOREMAN WANTED FOR small brass foundry in East. Must be competent to make all kinds of alloy castings. Special knowledge of aluminum castings desirable. State experience and salary wanted. Address Box 760, THE FOUNDRY, Cleveland.

IF YOU ARE OPEN TO OVERTURES FOR new connection, and qualified for a salary between $2500 and $25,000, your response to this announcement is invited. The undersigned provides a thoroughly organized service, of recognized standing and reputation, through which preliminaries are negotiated confidentially for positions of the calibre indicated. The procedure is individualized to each client's personal requirement; your identity covered and present position protected. Established seventeen years. Send only name and address for details. R. W. Bixby, Inc., 101 Downtown Building, Buffalo, New York.

$3000-$30,000. MEN FIND OUR SERVICE effective in making connections. Individual. Confidential. Personally planned by JACOB PENN. All foundry owners and officials know him, believe in him. Not agency. Jacob Penn, Incorporated, 9 Park Place, New York.

SALES REPRESENTATIVE WANTED TO handle foundry supplies, aluminum, scales and coke in Connecticut and Western part of Massachusetts. Prefer man now handling non-conflicting line. Commission basis only. Address Box 770, THE FOUNDRY, Cleveland.

WANTED

Superintendent electric steel foundry. Location Australia. Capacity 200 tons monthly locomotive and car castings. Must be qualified to control output from raw material to finished castings. Will pay traveling expenses to Australia and return expenses after twelve months if applicant desires returning. Give full particulars, past experience, reference and qualifications. State salary expected. Address Box 729, THE FOUNDRY, Cleveland.

Help Wanted

WANTED

For Chief Inspector of a large automobile foundry. High grade man who has had experience on cylinder blocks and cylinder block patterns and machining of cylinder blocks. Give references and salary desired. Address Box 732, THE FOUNDRY, Cleveland.

WANTED

General Foundry foreman capable of controlling jobbing electric steel foundry, capacity 200 tons monthly locomotive and car castings. Location Australia. Minimum 12 months. Guaranteed will pay traveling expenses to Australia and return. Give full particulars, past experience, reference and qualifications. State salary expected. Address Box 730, THE FOUNDRY, Cleveland.

ENGINEER AS CHIEF INSPECTOR FOR open hearth steel plant in East. Steel foundry experience essential. Must be young, energetic, accurate, good executive and familiar with theory and practice of heat treating, gauging and testing. Give age, training, outline of experience and salary desired in first letter. Address Box 733, THE FOUNDRY, Cleveland.

METALLURGICAL CHEMIST WANTED for malleable plant in middle west. Must be thoroughly experienced in melting, furnace operation, metallurgy, and analysis of malleable iron. Give experience, references, and qualifications. Address Box 756, THE FOUNDRY, Cleveland.

ALUMINUM AND BRASS FOREMAN

Thoroughly experienced in production methods and nonferrous foundry practice. Give detailed experience in first letter. Excellent opportunity for advancement. Address Box 697, THE FOUNDRY, Cleveland.

STEEL FOUNDRY FOREMAN WANTED

By concern making high grade dry and green sand castings from 1 to 10,000 lbs. jobbing and production. Thoroughly experienced molder boss only need apply. Age around 40. State references, salary expected and full particulars about past performances in above line. Address Box 768, THE FOUNDRY, Cleveland.

Positions Wanted

UP-TO-DATE AND CAPABLE YOUNG foundryman of wide experience, all classes of work, liberal education, present employed, wants position as superintendent or foreman of gray iron foundry. Address Box 771, THE FOUNDRY, Cleveland.

CUPOLA FOREMAN WANTS POSITION where there are two or more cupolas in operation. Can mix strictly by analysis. Expert on this line. Age. 44. Address Box 772, THE FOUNDRY, Cleveland.

GRAY IRON FOUNDRYMAN WITH 30 years experience desires a new connection. Employed at present having held the same position as foreman during the past ten years. Address Box 773, THE FOUNDRY, Cleveland.

STEEL FOUNDRY SUPERINTENDENT, carbon or manganese, thoroughly efficient in modern foundry practice. Can lower manufacturing costs and meet competition. Address Box 765, THE FOUNDRY, Cleveland.

POSITION AS MALLEABLE FOUNDRY superintendent. Technical education. Twenty years foundry experience. Age 42. Address Box 761, THE FOUNDRY, Cleveland.

ROLLS—MAN THOROUGHLY EXPERI-enced in manufacture of chilled, sand, steel and alloy rolls from both metallurgical and mechanical standpoint. Best of reference. Available by first of year. Address Box 764, THE FOUNDRY, Cleveland.

MALLEABLE IRON FOUNDRY SUPERIN-tendent desires permanent connection with concern who wants cost reduction and increased production. Good organizer. Technically trained. Best references. Fourteen years experience. General jobbing and specializing modern methods. Address Box 757, THE FOUNDRY, Cleveland.

POSITION WANTED GENERAL FORE-man or superintendent. High grade gray iron and semi-steel castings. 24 years experience, 13 as foreman. Practical molder by trade. Floor and machine. 41 years of age. Married. Open shop preferred. Reference. Address Box 682, THE FOUNDRY, Cleveland.

Position Wanted

PRACTICAL FOUNDRYMAN WITH FIFteen years road sales experience desires position selling foundry supplies in central western territory. Best references. Address Box 763, THE FOUNDRY, Cleveland.

FIRST CLASS FOUNDRY SUPERINTENDent wishes to make a change the first of the year. Address Box 774, THE FOUNDRY, Cleveland.

WANTED:—POSITION AS FOUNDRY SUperintendent or foreman. 15 years experience as foreman in stove furnace and jobbing foundry. Thoroughly experienced on all improved methods. Address Box 128, THE FOUNDRY, Cleveland.

A HIGH GRADE FOUNDRY SUPERINtendent with proven ability desires to make new connections on the first of January. Less than 40 years of age, energetic, capable. 15 years executive experience on high grade castings. Able to obtain maximum production at minimum cost. Can remedy your troubles in the foundry and part of your troubles in the machine shop. Good rigger. Well versed on modern foundry equipment. Metallurgy and cupola practice. Can furnish best of references. Address Box 714, THE FOUNDRY, Cleveland.

METAL PATTERN MAKER WITH 30 years experience. 25 years as foreman, 7 years at present place. Desire to make change. Address Box 750, THE FOUNDRY, Cleveland.

POSITION WANTED AS METAL PATtern maker. 15 years experience, 5 years as foreman. Employed at present. Desire a change of location. Address Box 749, THE FOUNDRY, Cleveland.

PRACTICAL MOLDER WHO HAS worked up through the ranks to manager desires connection with a malleable or gray iron foundry as superintendent or production manager. Address Box 767, THE FOUNDRY, Cleveland.

PATTERNMAKER, WOOD AND METAL, 12 years as foreman in last position, brass, malleable and gray iron. Experience. Thoroughly familiar with production practice in foundry and core room. Address Box 742, THE FOUNDRY, Cleveland.

A YOUNG STEEL FOUNDRY FOREMAN with 18 years experience on all classes of work is open for a position. Knows the game well, practical and active. Address Box 689, THE FOUNDRY, Cleveland.

CAN YOU USE A FOUNDRY SUPERINtendent who is anxious to connect with progressive organization? His experience covers gray iron, molding, coremaking, paternmaking as well as being an expert rigger. Have 18 years of foundry experience, eight years being in charge of foundry operations. Married man, under 40 years of age. Address Box 709, THE FOUNDRY, Cleveland.

Position Wanted

MANUFACTURING EXECUTIVE, WITH AN established record in handling management, marketing, finance and other vital problems in connection with foundry, machine and allied industries is available for service as General Manager or Sales Manager with reliable company. Experience covers all positions from accountant to secretary-treasurer including fourteen years as general manager. The ability to effect reorganization and the building up of production and sales has been thoroughly demonstrated. Address Box 769, THE FOUNDRY, Cleveland.

GRAY IRON FOUNDRYMAN UNDER 40 with 24 years experience, desires position as superintendent or foreman. Practical molder and coremaker. Seven years superintendent jobbing and production work. Good rigger. Mix by analysis. Address Box 681, THE FOUNDRY, Cleveland.

FOUNDRYMEN NOTICE

Are you looking for a position? Quite a number of Foundrymen have written us at various times asking that we make up their Position Wanted advertisements for them.

If you want to insert a small ad in the Classified Section but are not sure about the way it should be written just write us giving all your past experience and also stating the type of position you would like to get. Address your letter to the Classified Ad Dept., THE FOUNDRY, Cleveland. We'll try to do all we can to make up an advertisement that will draw results.

FOUNDRY MANAGERS
WANTED TO WRITE US FOR TECHNICALLY-TRAINED, PRACTICAL GRAY IRON OR STEEL, FOUNDRY FOREMEN OR SUPERINTENDENTS. NO CHARGE.
McLAIN'S SYSTEM, INC.
804 GOLDSMITH BLDG.
MILWAUKEE, WIS.

ENAMELER—FOUNDRYMAN
Practical, experienced in cast iron sanitary enameled ware. Up-to-date molding methods. Have enamel recipes. Wish new connection. Expert in keeping troubles to minimum. Address Box 707, THE FOUNDRY, 220 Broadway, New York, N. Y.

PRODUCTION ENGINEER, SUPERINtendent or equivalent. Thirty-six, married and technically trained with twenty years experience. Trained for production of engineering equipment or jobbing shop work in foundry and machine plants. Familiar with costs, estimating, office routine, systematizing, planning, scheduling, purchasing and some sales. Employed but desire change. Address Box 747, THE FOUNDRY, Cleveland.

STEEL FOUNDRY SUPERINTENDENT wants position as superintendent or general foreman, experienced open hearth or electric steel castings. Practical in every detail. Address Box 731, THE FOUNDRY, Cleveland.

Position Wanted

GRAY IRON FOUNDRY SUPERINTENDent. Twenty years experience in jobbing and production foundries, last five as foundry superintendent of large heating boiler foundry. Age 42. Address Box 762, THE FOUNDRY, Cleveland.

FOUNDRYMAN WITH WIDE EXPERIence in operation and supervision of old and continuous type foundry desires new connection. Experience covers charging, lining and operating. Can mix by analysis for any class of castings. Will operate shop with low labor cost. Best of references can be furnished. Address Box 758, THE FOUNDRY, Cleveland.

CHEMIST AND METALLURGIST WITH 8 years experience in gray iron and steel foundries desires change. Address Box 755, THE FOUNDRY, Cleveland.

PRACTICAL ROLL FOUNDRY MAN wants work. No matter what the roll is used for I know the mechanical end. Also well up in gray iron. Prefer job where rolls for all purposes and special chilled castings are made. Address Box 751, THE FOUNDRY, Cleveland.

POSITION WANTED
A high grade foundry superintendent with proven ability desires to make new connection with a good live concern. Am 38 years of age, energetic and capable. Twelve years executive experience. Production and jobbing work. Able to obtain maximum production at minimum cost. Good rigger. Well versed on modern foundry equipment. Mix iron by analysis. Can furnish best of references. Address Box 752, THE FOUNDRY, Cleveland.

METAL PATTERN MAKER, NOW EMployed, who has broad foundry experience, wants a broader position. Besides being first class pattern maker he is also a bench molder and machine molder, on both light and heavy castings. Can estimate pattern work and can Mold A1 aluminum match plates, can do rigging for sensible maximum production. Age. 47. Dependable. Reference furnished. Address Box 754, THE FOUNDRY, Cleveland.

WANTED POSITION AS EFFICIENCY man in brass foundry and assist in detail work. Familiar with all phases of the business. Address Box 698, THE FOUNDRY, Cleveland.

BRASS FOUNDRY FOREMAN
Situation Wanted as brass foundry foreman. Twenty-five years' experience in brass foundry. Understands production work, machine and matchplate work. First class man on metals for screw machine work. Address Box 766, THE FOUNDRY, Cleveland.

PATTERN SHOP FOREMAN WITH 25 years experience, 12 of which were spent as foreman and assistant superintendent is open for a position. Thoroughly experienced in the manufacture of malleable castings, gray iron and brass. Would like position with malleable foundry or manufacturing concern. Address Box 612, THE FOUNDRY, Cleveland.

Classified Advertisements

For Sale

FOR SALE

Roots Blowers—3", 4", 8", and 10" outlet.
Shaking Barrels 5, and 6' on steel stands, one tilting.
Sash weight patterns, all sizes.
NORTH AMERICAN HARDWARE CO.
1400 Water St., Minneapolis, Minn.

FOR SALE

One 7 ft. x 14 ft. three cylinder, Norcross Plain Jarring Machine. Good condition.
One 36" x 72" Pridmore Elec. Jarring Machine with stripping device. Can be used as plain jarr. Used less than a month.
Address Box 710, THE FOUNDRY, Cleveland.

HINES FLASKS

We have a quantity of Hines Slip Flasks and jackets to match which we wish to dispose of in job lot at a greatly reduced price. Miller Mfg. Company, Fremont, Ohio.

FOR SALE

Two Sullivan Air Compressors practically good as new—capacity 450 ft. per min. Both machines complete with 40 H.P. motors. Air receiver tanks. Belts and piping. For full description address Village Clerk, River Forest, Illinois.

CRANES—ELECTRIC

2 5-ton Bedford 50' span, cage control, 3 phase, 60 cycle, 220 volt.

CRANE TROLLEY

1 Milwaukee Crane Trolley 10-ton to run on rails 7'0" center, main hoist 27½ HP Westinghouse type K No. 2 230 V DC Motor, 535 RPM. Racking Motor Westinghouse type K No. 7 230 V DC 4½ HP., 715 RPM. Will furnish bridge to suit.

CRANE MAGNETS

2 E C & M Magnets, No. 5, type SA-55".

ELECTRIC HOISTS

1 Sprague Type S-1½-ton cap. 26' lift or 1-ton cap. 15' lift, 3-60-440, with trolley.
2 Sprague 3-ton, 220 DC, 2 motor, floor control.
1 Motor operated 2-ton Shepard Trolley, 220 DC, Crocker-Wheeler Motor.
1 3-ton Sprague 3-60-220 with trolley, 2 motor 5 HP., 1200 RPM. on rack, 5 HP., 1200 RPM on hoist, 35' lift at 15' per minute.
1 5-ton P & H 220 volt DC with trolley, 2 motor, floor control.
1 4-ton Northern 220 volt DC with trolley, 2 motor, floor control.

BUCKETS

1 Electric Hayward motor driven ¼ yd., 220 DC.
1 2 yard—P. & H. single line.

FLASKS

500—17 x 18 x 5" cope 4" drag—Sterling.
100—16 x 16 x 5" cope 5" drag—Sterling.
200—18 x 24 x 8" cope 3" drag—Sterling.

SAND MIXERS

1 Simpson 6" pan, belt drive.

COMPRESSORS

1 Ingersoll-Rand Type XB-2—16—10x14, 599 cu. ft. cap. with inter-cooler, short belt drive, can furnish 100 H.P. 3-60-220 Motor, if required.
1 12 x 10 Ingersoll Rand Class ER-1 with unloader, 50 H.P. Motor.
1 Sullivan 10 x 10—250 cu. ft. capacity.

WRITE for our list No. 53, covering COMPLETE LINE of NEW and USED FOUNDRY EQUIPMENT.

SCULLY-JONES & COMPANY
1901 S. ROCKWELL ST.
CHICAGO, ILL.

For Sale

FOUNDRY EQUIPMENT

Complete stock of Rebuilt Guaranteed Cupolas, Blowers, Grinders, Sand Blast Outfits, Tumbling Mills, Sand Mixers, Cranes and Hoists.

THIS WEEK'S SPECIAL

(1)—10-ton Paxson Ladle, worm geared, used one heat only. ($190.00).
(1)—42" Pangborn Rotary Sand Blast Table, type L. E. 95% new. Price ($275.00).

T. B. MacCABE,
2230 W. Lippincott St.,
Philadelphia, Pa.
Long distance phone—Tioga 5456

FOR SALE

One 11 ft. tractor type Sandslinger fitted with jib cranes and heap leveling device—440 volt 60 cycle, three phase motors—hydraulic turning device—used one year.
AMERICAN SEATING COMPANY
Grand Rapids, Mich.

FOR SALE

One 8 x 8 Chicago pneumatic air compressor, with motor, (15HP-2 Pha.) Tank and all necessary fittings, can be bought very reasonable. This equipment has been used very little and has had the best of care. Rolle Casting Company, 2814 Bridge Street, Philadelphia, Pa.

FOR SALE

1—Foundry Cupola—72"
1—Foundry Cupola—62"
FAGAN IRON WORKS
14th & Coles St., Jersey City, N. J.

FOR SALE

Thirteen 30 tons hot metal top pour ladles mounted on standard gauge railroad track wheels. All in excellent condition.
VALLEY MOULD AND IRON CORP.
Hubbard, Ohio.

For Sale

MOLDING MACHINES

Complete stock of New and Re-Manufactured Molding Machines of all types and sizes.

STRIPPING PLATE MACHINES
SQUEEZERS—HAND AND POWER
JOLT MACHINES—PLAIN AND COMBINATION

Write for complete list

CHAMPION FOUNDRY & MACHINE CO.
3018 West 21st Place
Chicago, Ill.

FOR SALE

1—Counting scale, National Scale Company, Model 100. Used very little. Cost $350 new.
1—American Foundry & Machine 18" sand blast barrel. Replaced by us with larger machine. Will sell cheap for quick disposal.
J. S. WHITE COMPANY
22 Dexter Street Pawtucket, R. I.

FOR SALE

One No. 4 Connersville Positive Pressure, belt driven blower, with or without 10 HP AC Motor; both in good condition. Reasonable. Wisconsin Gray Iron Foundry Co., Milwaukee, Wis.

BEFORE BUYING EQUIPMENT AT ANY price send specifications of your needs and get our offers on Good Machinery in Air Compressors, Receivers, Blowers of all makes, size and capacities, for Cupolas, Furnaces, Exhausters, for Dust Ventilation and every service. Maxon Premix Blowers—Buckeye, Hausfeld, Monarch Brass Furnaces, Cupolas, Molding Machines, Sand Blast Tanks, etc. 5400' Spencer Turbine Blower, 2500' Gen. Electric Blower A. C. Motor. Root and Connersville Blowers in great variety.
CLIFTON MACHINERY CO.
1023 West 6th St., Cincinnati, Ohio.

Foundries Wanted, For Sale or Lease

FOR RENT—FOUNDRY, CHICAGO, located central part, equipped with No. 5 Cupola, Blower, Tumblers, Grinders and Cranes. Address Box 745, THE FOUNDRY, Cleveland.

FOR SALE

Iron foundry, location central Ohio, operating successfully. Owner retiring. No. 6 Whiting Cupola, other equipment in proportion. Priced at one-fourth its value. Opportunity to get profitable business for small investment. Address Box 715, THE FOUNDRY, Cleveland.

FOUNDRY WANTED

To lease with option of purchase preferably in Western mining district. Full details covering terms, location, capacity of plant, buildings, yards, etc.; class of castings and tonnage produced first six months of 1927 required in first letter. Address Box 759, THE FOUNDRY, Cleveland.

FOR SALE

Receiver authorizes extreme sacrifice. Complete Indiana Manufacturing Plant, approximately 75,000 square feet. Fully equipped foundry 100 x 200; Machine shop 100 x 200; Pattern Shop, Offices, etc. 5 acres; switch. Lowest labor market. Write for "Bargains in Foundries." Fantus Factory Locating Service, 1325 South Oakley Ave., Chicago.

Index to Advertisements

A

Adams Co. 29
Ajax Metal Co. 3
Alloys & Products, Inc. 89
American Boron Products Co., Inc. 88
American Bridge Co. 87
American Foundry Equipment Co. 15
American Mond Nickel Co. 88, 89
American Saw & Mfg. Co. 77
American Steel Abrasives Co. 81
American Tripoli Co. 82
American Vent Wax Co. 82
Arcade Manufacturing Co. 25
Austin Co., The ..... Back Cover
Axmann Sand-Throwing Machine Co. 38

B

Beardsley & Piper Co. 27, 28
Bethlehem Steel Co. 39
Bristol Co., The 71
British Aluminium Co., Ltd. 89
Brosius, Edgar E., Inc. 73
Bury Compressor Co. 83

C

Canton Pneumatic Co. 83
Cape May Sand Co. 79
Carborundum Co. 66
Chain Products Co. 77
Champion Foundry & Machine Co. 93
Chicago Pneumatic Tool Co. 40
Cleveland Pneumatic Tool Co. 83
Clifton Machinery Co. 93
Corn Products Refining Co. 18
Curtis Pneumatic Machinery Co. 62

D

Demmler, Wm., & Brothers 77
Detroit Electric Furnace Co. 43
Diamond Clamp & Flask Co. 21
Dietert, Harry W. 77
Dings Magnetic Separator Co. 12
Direct Separator Co. 85
Dixon, Joseph, Crucible Co. 82
Driver-Harris Co. 65

F

Fisher, Alfred, Furnace Co. 87
Fisher Governor Co. 73
Foundry Equipment Co. 31
Foundry Manganese Co. 88
Foundry Supplies Mfg. Co. 34
Franklin Core Rod & Gagger Co. 77
Fuller Lehigh Co. 90

G

General Electric Co. 52, 56
Globe Steel Abrasive Co. 79

H

Hagan, George J., Co. 90
Hanna, M. A., Co. 88
Harnischfeger Corporation 58
Hauck Manufacturing Co. 86
Hayward Co., The 73
Hercules Powder Co., Inc. 84
Herman Pneumatic Machine Co. 33
Hillman Coal & Coke Co. 88
Hillside Fluor Spar Mines 88
Hoevel Mfg. Corp. 85
Holcroft & Co. 90

I

Illinois Clay Products Co. 45, 46
Imperial Brass Mfg. Co. 75
Industrial Equipment Co. 69
Industrial Minerals Co. 32
Ingersoll-Rand Co. 42
International Molding Machine Co. 35
International Nickel Co. 41
International Oxygen Co. 75

J

Jenkins Bros. 75

K

Kawin, Charles C., Co. 90
Keener Sand & Clay Co. 79
Kellogg, Spencer, & Sons, Inc. 8, 9
Knefler-Bates Mfg. Co. 20
Knickerbocker Co. 86
Koven, L. O., & Brother, Inc. 85

L

Lava Crucible Co. of Pittsburgh 85
Lindsay-McMillan Co. 26
Link-Belt Co. 96

M

McCann-Harrison Corp. 57
McCormick, J. S., Co. 30
MacCabe, T. B. 93
Magnetic Manufacturing Co. 81
Malleable Iron Fittings Co. 53
Marshall Blow Pipe Co. 81
Mathews Conveyer Co. 59
Mathieson Alkali Works, Inc. 63
Menefee Foundry Co., Inc. 22
Metal & Thermit Corporation 75
Mifflin Chemical Corporation 82
Milwaukee Electric Crane & Mfg. Corp. 73
Modern Pouring Device Co. 73
Moline Iron Works 51
Moltrup Steel Products Co. ..... Front Cover
Mott Sand Blast Mfg. Co., Inc. 84

N

National Engineering Co. 16
New Haven Sand Blast Co. 19
Niagara Falls Smelting & Refining Corp. 89
Northern Engineering Works 60

O

Ottawa Silica Co. 69
Oxweld Acetylene Co. ..... Inside Front Cover

P

Pangborn Corporation 11
Penn Foundry & Mfg. Co. 69
Pennsylvania Pump & Compressor Co. 83
Phillips & McLaren Co. 84
Pilling & Co., Inc. 88
Pittsburgh Crushed Steel Co. 10
Pittsburgh Electric Furnace Corp. 87
Portage Silica Co. 79
Prest-O-Lite Co., Inc. 47
Production Equipment Co. 36
Pulmosan Safety Equipment Corp. 84
Pyrometer Instrument Co. 71

Q

Queen's Run Refractories Co., Inc. 84
Quigley Furnace Specialties Co., Inc. 86

R

Robinson, Wm. C., & Son Co. 24
Ross-Tacony Crucible Co. 86
Royer Foundry & Machine Co. 14

S

Safety Clothing Co. 81
Scully-Jones & Co. 93
Shore Instrument & Mfg. Co., Inc. 71
Sly, W. W., Mfg. Co. 17
Smith-Monroe Co. 75
Smith, Werner, G., Co. 4, 5
Smooth-On Mfg. Co. 61
Spencer Turbine Co. 85
Sprague Electric Hoist Division of Shepard Electric Crane & Hoist Co. 67
Standard Sand & Machine Co. 6, 7
Steel Shot & Grit Co. 10
Stevens, Frederic B., Inc. ..... Inside Back Cover
Strand, N. A., & Co. 73
Sullivan Machinery Co. 50
Swartwout Co., The 55
Swindell, William, & Brothers 87

T

Tabor Manufacturing Co. 49
Timken Roller Bearing Co. 44
Titanium Alloy Manufacturing Co. 37
Truscon Steel Co. 23

U

United Compound Co. 82
U. S. Aluminum Match Plate Co. 77
United States Graphite Co. 83
U. S. Refractories Corp. 84
United States Silica Co. 13

V

Vickers, Charles 90

W

Westinghouse Traction Brake Co. 48
Whitehead Brothers Co. 79
Whiting Corporation 69
Williams & Co., Inc. 89
Williams, G. H., Co. 71

Y

Young Brothers Co. 95

"Where-to-Buy," Page 68 | Classified Advertisers, Pages 91-93 | Table of Contents, Page 949

FUEL?

Is coke at $0.16 per million B. T. U. or electricity at $5.86 the cheapest fuel for your foundry ovens—or would it be cheaper for you to use fuel oil at $0.70 per million B. T. U. in preference to city gas at $0.84?

Frankly there are too many other factors involved to arrive at a conclusion on the basis only of heating costs. Consideration must also be given to the amount of operating labor required, the question of accurate heat control and various other factors which directly influence operating costs.

The development of improved heaters and heating equipment has also been a force in increasing the advantages of certain of the fuels.

Consequently the range of possibilities in the use of fuels makes it increasingly desirable to base a decision involving new oven equipment or the revision of old equipment on the recommendation of an organization constantly in contact with these problems—an organization with an abundance of practical experience in the design and manufacture of ovens for all types of fuel and heating.

YOUNG BROS. COMPANY

6508 Mack Avenue, Detroit, Michigan

District Sales Offices:

30 Church Str., New York
1424 Guarantee Title, Cleveland
410 Granite Bldg., St. Louis
419 New Call Bldg., San Francisco
908 Ellicott Square, Buffalo
20 E. Jackson Blvd., Chicago
807 San Fernando Bldg., Los Angeles
248 Central Bldg., Seattle, Wash.
10 High Str., Boston

YOUNG BROS. CO. OVENS — OUR BOLTLESS JOINT — DETROIT

—OVENS FOR—

Core and mold baking.
Low Temperature heat treating.
Drying.
Japanning and enameling.
Electrical appliance baking.
Adapted to all methods of heating

INDUSTRIAL OVENS

Steel Foundries Now Save Money Reclaiming Sand

SAND of course doesn't cost so much, but handling refuse and new sand does. Refuse, cores, gaggers, dust and broken sand can all be removed on a Link-Belt Vibrating Screen. Ask our nearest office for full information and a copy of Vibrating Screen Book No. 862.

LINK-BELT COMPANY

Leading Manufacturers of Elevating, Conveying, and Power Transmission Machinery and Chains

3209

CHICAGO, 300 W. Pershing Road

INDIANAPOLIS, 200 S. Belmont Ave.

PHILADELPHIA, 2045 Hunting Park Ave.

Atlanta - - - - - 511 Haas-Howell Bldg.
Birmingham, Ala. - 229 Brown-Marx Bldg.
Boston - - - - - - 1103-4 Statler Bldg.
Buffalo - - - - - 554 Ellicott Square
Cleveland - - - - 527 Rockefeller Bldg.
Dallas, Texas, 1221 Mercantile Bank Bldg.
Denver - - - - - - - 520 Boston Bldg.
Detroit - - - - - - 5038 Linsdale Ave.
Huntington, W. Va.- Robson-Prichard Bldg.
Kansas City, Mo., R. 436, 1002 Baltimore Ave.
Louisville, Ky. - - - - - 349 Starks Bldg.
New Orleans - 504 New Orleans Bank Bldg.
New York - - - - 2676 Woolworth Bldg
Pittsburgh - - - - - - 335 Fifth Ave.
St. Louis - - - - - - - 3638 Olive St.
Wilkes-Barre - 826 Second Nat'l Bank Bldg.

H. W. CALDWELL & SON CO.:—Chicago, Western Ave., 17th and 18th Sts.; New York, 2676 Woolworth Bldg.

LINK-BELT MEESE & GOTTFRIED CO.:—San Francisco, 19th and Harrison Sts.; Los Angeles, 361-369 S. Anderson St.; Seattle, 820 First Ave., S. Portland, Ore., 67 Front St.; Oakland, Calif., 526 Third St.

In Canada—LINK-BELT LIMITED—Toronto and Montreal.

LINK-BELT

Sand Preparation and Handling Equipment